**** WARNING ** WARNING ** WARNING ** WARNING ****
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STATE OF CALIFORNIA

DEPARTMENT OF TRANSPORTATION

NOTICE TO CONTRACTORS

AND

SPECIAL PROVISIONS

FOR BUILDING CONSTRUCTION IN

PLUMAS COUNTY NEAR CHESTER AT THE CHESTER MAINTENANCE STATION

DISTRICT 02, ROUTE 5707

For Use in Connection with Standard Specifications Dated JULY 1999, Standard Plans Dated JULY 1999, and Labor Surcharge and Equipment Rental Rates.

CONTRACT NO. 02-350704

02-Plu-5707

Bids Open: August 20, 2002
Dated: July 22, 2002

OSD

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IMPORTANT SPECIAL NOTICES

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- Attention is directed to the Notice to Contractor and Section 1, "Plans and Specifications," of the special provisions regarding references to the District and District Director's Office. The Office of the District Director for the Northern Region is located at Marysville.

- **Payment Bonds**
  Attention is directed to Section 5 of the Special Provisions, regarding contract bonds. The payment bond shall be in a sum not less than one hundred percent of the total amount payable by the terms of the contract.

- Attention is directed to Section 1, "Specifications and Plans," of these special provisions for Amendments To July 1999 Standard Specifications. Amendments to the various sections of the Standard Specification have been consolidated into Section 1 and dated to reflect the most recent revision.

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DEPARTMENT OF TRANSPORTATION

NOTICE TO CONTRACTORS

CONTRACT NO. 02-350704

02-Plu-5707

Sealed proposals for the work shown on the plans entitled:

STATE OF CALIFORNIA; DEPARTMENT OF TRANSPORTATION; PROJECT PLANS FOR BUILDING CONSTRUCTION IN PLUMAS COUNTY NEAR CHESTER AT THE CHESTER MAINTENANCE STATION

will be received at the Department of Transportation, 1120 N Street, Room 0200, MS #26, Sacramento, CA 95814, until 2 o'clock p.m. on August 20, 2002, at which time they will be publicly opened and read in Room 0100 at the same address.

Proposal forms for this work are included in a separate book entitled:

STATE OF CALIFORNIA; DEPARTMENT OF TRANSPORTATION; PROPOSAL AND CONTRACT FOR BUILDING CONSTRUCTION IN PLUMAS COUNTY NEAR CHESTER AT THE CHESTER MAINTENANCE STATION

General work description: Construct Maintenance/Office Building, Equipment Canopy, Utility Building, and Material Bins.

This project has a goal of 3 percent disabled veteran business enterprise (DVBE) participation.

No prebid meeting is scheduled for this project.

Bids are required for the entire work described herein.

At the time this contract is awarded, the Contractor shall possess either a Class A license or Class B license or a combination of Class C licenses which constitutes a majority of the work.

The Contractor must also be properly licensed at the time the bid is submitted, except that on a joint venture bid a joint venture license may be obtained by a combination of licenses after bid opening but before award in conformance with Business and Professions Code, Section 7029.1.

This contract is subject to state contract nondiscrimination and compliance requirements pursuant to Government Code, Section 12990.

Preference will be granted to bidders properly certified as a "Small Business" as determined by the Department of General Services, Office of Small Business Certification and Resources at the time of bid opening in conformance with the provisions in Section 2-1.05, "Small Business Preference," of the special provisions, and Section 1896 et seq, Title 2, California Code of Regulations. A form for requesting a "Small Business" preference is included with the bid documents. Applications for status as a "Small Business" must be submitted to the Department of General Services, Office of Small Business Certification and Resources, 1531 "I" Street, Second Floor, Sacramento, CA 95814, Telephone No. (916) 322-5060.

A reciprocal preference will be granted to "California company" bidders in conformance with Section 6107 of the Public Contract Code. (See Sections 2 and 3 of the special provisions.) A form for indicating whether bidders are or are not a "California company" is included in the bid documents and is to be filled in and signed by all bidders.

The District in which the work for this project is located has been incorporated into the Department's Northern Region. References in the Standard Specifications or in the special provisions to the district shall be deemed to mean the Northern Region. The office of the District Director for the Northern Region is located at Marysville.

Project plans, special provisions, and proposal forms for bidding this project can only be obtained at the Department of Transportation, Plans and Bid Documents, Room 0200, MS #26, Transportation Building, 1120 N Street, Sacramento, California 95814, FAX No. (916) 654-7028, Telephone No. (916) 654-4490. Use FAX orders to expedite orders for project plans, special provisions and proposal forms. FAX orders must include credit card charge number, card expiration date and authorizing signature. Project plans, special provisions, and proposal forms may be seen at the above Department of Transportation office and at the offices of the District Directors of Transportation at Irvine, Oakland, and the district in which the work is situated. Standard Specifications and Standard Plans are available through the State of California, Department of Transportation, Publications Unit, 1900 Royal Oaks Drive, Sacramento, CA 95815, Telephone No. (916) 445-3520.

Cross sections for this project are not available.

The successful bidder shall furnish a payment bond and a performance bond.

Pursuant to Section 1773 of the Labor Code, the general prevailing wage rates in the county, or counties, in which the work is to be done have been determined by the Director of the California Department of Industrial Relations. These wages are set forth in the General Prevailing Wage Rates for this project, available at the Labor Compliance Office at the offices of the District Director of Transportation for the district in which the work is situated, and available from the California Department of Industrial Relations' Internet Web Site at: http://www.dir.ca.gov. Future effective general prevailing wage rates which have been predetermined and are on file with the Department of Industrial Relations are referenced but not printed in the general prevailing wage rates.

DEPARTMENT OF TRANSPORTATION

Deputy Director Transportation Engineering

Dated July 22, 2002

MCT

COPY OF ENGINEER'S ESTIMATE

(NOT TO BE USED FOR BIDDING PURPOSES)

02-350704

Item	Item Code	Item	Unit of Measure	Estimated Quantity
1	024370	PLACE ASPHALT CONCRETE DIKE (TYPE A MODI FIED)	M	18
2	074029	TEMPORARY SILT FENCE	M	120
3	074030	TEMPORARY STRAW BALE	M	30
4	190101	ROADWAY EXCAVATION	M3	1840
5	260201	CLASS 2 AGGREGATE BASE	M3	2500
6	390101	ASPHALT CONCRETE	TONN	2360
7	394002	PLACE ASPHALT CONCRETE (MISCELLANEOUS AREA)	M2	40
8	994650	BUILDING WORK	LS	LUMP SUM

STATE OF CALIFORNIA

DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISIONS

Annexed to Contract No. 02-350704

SECTION 1. SPECIFICATIONS AND PLANS

The work embraced herein shall conform to the provisions in the Standard Specifications dated July 1999, and the Standard Plans dated July 1999, of the Department of Transportation insofar as the same may apply, and these special provisions.

The District in which the work for this project is located has been incorporated into the Department's Northern Region. References in the Standard Specifications or in these special provisions to the district shall be deemed to mean the Northern Region. The office of the District Director for the Northern Region is located at Marysville.

In case of conflict between the Standard Specifications and these special provisions, the special provisions shall take precedence over and shall be used in lieu of the conflicting portions.

AMENDMENTS TO JULY 1999 STANDARD SPECIFICATIONS

UPDATED JUNE 13, 2002

Amendments to the Standard Specifications set forth in these special provisions shall be considered as part of the Standard Specifications for the purposes set forth in Section 5-1.04, "Coordination and Interpretation of Plans, Standard Specifications and Special Provisions," of the Standard Specifications. Whenever either the term "Standard Specifications is amended" or the term "Standard Specifications are amended" is used in the special provisions, the text or table following the term shall be considered an amendment to the Standard Specifications. In case of conflict between such amendments and the Standard Specifications, the amendments shall take precedence over and be used in lieu of the conflicting portions.

SECTION 2: PROPOSAL REQUIREMENTS AND CONDITIONS

Issue Date: June 6, 2002

Section 2-1.03, "Examination of Plans, Specifications, Contract, and Site of Work," of the Standard Specifications is amended to read:

2-1.03 Examination of Plans, Specifications, Contract, and Site of Work

- The bidder shall examine carefully the site of the work contemplated, the plans and specifications, and the proposal and contract forms therefor. The submission of a bid shall be conclusive evidence that the bidder has investigated and is satisfied as to the general and local conditions to be encountered, as to the character, quality and scope of work to be performed, the quantities of materials to be furnished and as to the requirements of the proposal, plans, specifications and the contract.
- The submission of a bid shall also be conclusive evidence that the bidder is satisfied that the character, quality and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information was reasonably ascertainable from an inspection of the site and the records of exploratory work done by the Department as shown in the bid documents, as well as from the plans and specifications made a part of the contract.

• Where the Department has made investigations of site conditions including subsurface conditions in areas where work is to be performed under the contract, or in other areas, some of which may constitute possible local material sources, bidders or contractors may, upon written request, inspect the records of the Department as to those investigations subject to and upon the conditions hereinafter set forth.

• Where there has been prior construction by the Department or other public agencies within the project limits, records of the prior construction that are currently in the possession of the Department and which have been used by, or are known to, the designers and administrators of the project will be made available for inspection by bidders or contractors, upon written request, subject to the conditions hereinafter set forth. The records may include, but are not limited to, as-built drawings, design calculations, foundation and site studies, project reports and other data assembled in connection with the investigation, design, construction and maintenance of the prior projects.

• Inspection of the records of investigations and project records may be made at the office of the district in which the work is situated, or in the case of records of investigations related to structure work, at the Transportation Laboratory in Sacramento, California.

• When a log of test borings or other record of geotechnical data obtained by the Department's investigation of surface and subsurface conditions is included with the contract plans, it is furnished for the bidders' or Contractor's information and its use shall be subject to the conditions and limitations set forth in this Section 2-1.03.

• In some instances, information considered by the Department to be of possible interest to bidders or contractors has been compiled as "Materials Information." The use of the "Materials Information" shall be subject to the conditions and limitations set forth in this Section 2-1.03 and Section 6-2, "Local Materials."

• When cross sections are not included with the plans, but are available, bidders or contractors may inspect the cross sections and obtain copies for their use, at their expense.

• When cross sections are included with the contract plans, it is expressly understood and agreed that the cross sections do not constitute part of the contract, do not necessarily represent actual site conditions or show location, character, dimensions and details of work to be performed, and are included in the plans only for the convenience of bidders and their use is subject to the conditions and limitations set forth in this Section 2-1.03.

• When contour maps were used in the design of the project, the bidders may inspect those maps, and if available, they may obtain copies for their use.

• The availability or use of information described in this Section 2-1.03 is not to be construed in any way as a waiver of the provisions of the first paragraph in this Section 2-1.03 and bidders and contractors are cautioned to make independent investigations and examinations as they deem necessary to be satisfied as to conditions to be encountered in the performance of the work and, with respect to possible local material sources, the quality and quantity of material available from the property and the type and extent of processing that may be required in order to produce material conforming to the requirements of the specifications.

• The Department assumes no responsibility for conclusions or interpretations made by a bidder or contractor based on the information or data made available by the Department. The Department does not assume responsibility for representation made by its officers or agents before the execution of the contract concerning surface or subsurface conditions, unless that representation is expressly stated in the contract.

• No conclusions or interpretations made by a bidder or contractor from the information and data made available by the Department will relieve a bidder or contractor from properly fulfilling the terms of the contract.

SECTION 5: CONTROL OF WORK

Issue Date: December 31, 2001

Section 5-1.02A, "Trench Excavation Safety Plans," of the Standard Specifications is amended to read:

5-1.02A Excavation Safety Plans

• The Construction Safety Orders of the Division of Occupational Safety and Health shall apply to all excavations. For all excavations 1.5 m or more in depth, the Contractor shall submit to the Engineer a detailed plan showing the design and details of the protective systems to be provided for worker protection from the hazard of caving ground during excavation. The detailed plan shall include any tabulated data and any design calculations used in the preparation of the plan. Excavation shall not begin until the detailed plan has been reviewed and approved by the Engineer.

• Detailed plans of protective systems for which the Construction Safety Orders require design by a registered professional engineer shall be prepared and signed by an engineer who is registered as a Civil Engineer in the State of California, and shall include the soil classification, soil properties, soil design calculations that demonstrate adequate stability of the protective system, and any other design calculations used in the preparation of the plan.

• No plan shall allow the use of a protective system less effective than that required by the Construction Safety Orders.

• If the detailed plan includes designs of protective systems developed only from the allowable configurations and slopes, or Appendices, contained in the Construction Safety Orders, the plan shall be submitted at least 5 days before the Contractor intends to begin excavation. If the detailed plan includes designs of protective systems developed from tabulated data, or designs for which design by a registered professional engineer is required, the plan shall be submitted at least 3 weeks before the Contractor intends to begin excavation.

• Attention is directed to Section 7-1.01E, "Trench Safety."

SECTION 19: EARTHWORK

Issue Date: December 31, 2001

The third paragraph of Section 19-1.02, "Preservation of Property," of the Standard Specifications is amended to read:

• In addition to the provisions in Sections 5-1.02, "Plans and Working Drawings," and 5-1.02A, "Excavation Safety Plans," detailed plans of the protective systems for excavations on or affecting railroad property will be reviewed for adequacy of protection provided for railroad facilities, property, and traffic. These plans shall be submitted at least 9 weeks before the Contractor intends to begin excavation requiring the protective systems. Approval by the Engineer of the detailed plans for the protective systems will be contingent upon the plans being satisfactory to the railroad company involved.

SECTION 42: GROOVE AND GRIND PAVEMENT

Issue Date: December 31, 2001

The last sentence of the first subparagraph of the third paragraph in Section 42-2.02, "Construction," of the Standard Specifications is amended to read:

After grinding has been completed, the pavement shall conform to the straightedge and profile requirements specified in Section 40-1.10, "Final Finishing."

SECTION 49: PILING

Issue Date: December 31, 2001

Section 49-1.05, "Driving Equipment," of the Standard Specifications is amended by adding the following paragraph after the seventh paragraph:

• The use of followers or underwater hammers for driving piles will be permitted if authorized in writing by the Engineer. When a follower or underwater hammer is used, its efficiency shall be verified by furnishing the first pile in each bent or footing sufficiently long and driving the pile without the use of a follower or underwater hammer.

The first and second paragraphs in Section 49-4.01, "Description," of the Standard Specifications are amended to read:

• Cast-in-place concrete piles shall consist of one of the following:

A. Steel shells driven permanently to the required bearing value and penetration and filled with concrete.
B. Steel casings installed permanently to the required penetration and filled with concrete.
C. Drilled holes filled with concrete.
D. Rock sockets filled with concrete.

• The drilling of holes shall conform to the provisions in these specifications. Concrete filling for cast-in-place concrete piles is designated by compressive strength and shall have a minimum 28-day compressive strength of 25 MPa. At the option of the Contractor, the combined aggregate grading for the concrete shall be either the 25-mm maximum grading, the 12.5-mm maximum grading, or the 9.5-mm maximum grading. Concrete shall conform to the provisions in Section 90, "Portland Cement Concrete," and Section 51, "Concrete Structures." Reinforcement shall conform to the provisions in Section 52, "Reinforcement."

The fourth paragraph in Section 49-4.03, "Drilled Holes," of the Standard Specifications is amended to read:

• After placing reinforcement and prior to placing concrete in the drilled hole, if caving occurs or deteriorated foundation material accumulates on the bottom of the hole, the bottom of the drilled hole shall be cleaned. The Contractor shall verify that the bottom of the drilled hole is clean.

The third paragraph in Section 49-6.02, "Payment," of the Standard Specifications is amended to read:

• The contract price paid per meter for cast-in-drilled-hole concrete piling shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all work involved in drilling holes, disposing of material resulting from drilling holes, temporarily casing holes and removing water when necessary, furnishing and placing concrete and reinforcement, and constructing reinforced concrete extensions, complete in place, to the required penetration, as shown on the plans, as specified in these specifications and in the special provisions, and as directed by the Engineer.

SECTION 50: PRESTRESSING CONCRETE

Issue Date: December 31, 2001

Section 50-1.02, "Drawings," of the Standard Specifications is amended by adding the following paragraph after the second paragraph:

• Each working drawing submittal shall consist of plans for a single bridge or portion thereof. For multi-frame bridges, each frame shall require a separate working drawing submittal.

Section 50-1.05, "Prestressing Steel," of the Standard Specifications is amended to read:

• Prestressing steel shall be high-tensile wire conforming to the requirements in ASTM Designation: A 421, including Supplement I; high-tensile seven-wire strand conforming to the requirements in ASTM Designation: A 416; or uncoated high-strength steel bars conforming to the requirements in ASTM Designation: A 722, including all supplementary requirements. The maximum mass requirement of ASTM Designation: A 722 will not apply.

• In addition to the requirements of ASTM Designation: A 722, for deformed bars, the reduction of area shall be determined from a bar from which the deformations have been removed. The bar shall be machined no more than necessary to remove the deformations over a length of 300 mm, and reduction will be based on the area of the machined portion.

• In addition to the requirements specified herein, epoxy-coated seven-wire prestressing steel strand shall be grit impregnated and filled in conformance with the requirements in ASTM Designation: A 882/A 882M, including Supplement I, and the following:

A. The coating material shall be on the Department's list of approved coating materials for epoxy-coated strand, available from the Transportation Laboratory.
B. The film thickness of the coating after curing shall be 381 μm to 1143 μm.
C. Prior to coating the strand, the Contractor shall furnish to the Transportation Laboratory a representative 230-g sample from each batch of epoxy coating material to be used. Each sample shall be packaged in an airtight container identified with the manufacturer's name and batch number.
D. Prior to use of the epoxy-coated strand in the work, written certifications referenced in ASTM Designation: A 882/A 882M, including a representative load-elongation curve for each size and grade of strand to be used and a copy of the quality control tests performed by the manufacturer, shall be furnished to the Engineer.
E. In addition to the requirements in Section 50-1.10, "Samples for Testing," four 1.5-m long samples of coated strand and one 1.5-m long sample of uncoated strand of each size and reel shall be furnished to the Engineer for testing. These samples, as selected by the Engineer, shall be representative of the material to be used in the work.
F. Epoxy-coated strand shall be cut using an abrasive saw.
G. All visible damage to coatings caused by shipping and handling, or during installation, including cut ends, shall be repaired in conformance with the requirements in ASTM Designation: A 882/A 882M. The patching material shall be furnished by the manufacturer of the epoxy powder and shall be applied in conformance with the manufacturer's written recommendations. The patching material shall be compatible with the original epoxy coating material and shall be inert in concrete.

• All bars in any individual member shall be of the same grade, unless otherwise permitted by the Engineer.

• When bars are to be extended by the use of couplers, the assembled units shall have a tensile strength of not less than the manufacturer's minimum guaranteed ultimate tensile strength of the bars. Failure of any one sample to meet this

requirement will be cause for rejection of the heat of bars and lot of couplers. The location of couplers in the member shall be subject to approval by the Engineer.

- Wires shall be straightened if necessary to produce equal stress in all wires or wire groups or parallel lay cables that are to be stressed simultaneously or when necessary to ensure proper positioning in the ducts.
- Where wires are to be button-headed, the buttons shall be cold formed symmetrically about the axes of the wires. The buttons shall develop the minimum guaranteed ultimate tensile strength of the wire. No cold forming process shall be used that causes indentations in the wire. Buttonheads shall not contain wide open splits, more than 2 splits per head, or splits not parallel with the axis of the wire.
- Prestressing steel shall be protected against physical damage and rust or other results of corrosion at all times from manufacture to grouting or encasing in concrete. Prestressing steel that has sustained physical damage at any time shall be rejected. The development of visible rust or other results of corrosion shall be cause for rejection, when ordered by the Engineer.
- Epoxy-coated prestressing steel strand shall be covered with an opaque polyethylene sheeting or other suitable protective material to protect the strand from exposure to sunlight, salt spray, and weather. For stacked coils, the protective covering shall be draped around the perimeter of the stack. The covering shall be adequately secured; however, it should allow for air circulation around the strand to prevent condensation under the covering. Epoxy-coated strand shall not be stored within 300 m of ocean or tidal water for more than 2 months.
- Prestressing steel shall be packaged in containers or shipping forms for the protection of the steel against physical damage and corrosion during shipping and storage. Except for epoxy-coated strand, a corrosion inhibitor which prevents rust or other results of corrosion, shall be placed in the package or form, or shall be incorporated in a corrosion inhibitor carrier type packaging material, or when permitted by the Engineer, may be applied directly to the steel. The corrosion inhibitor shall have no deleterious effect on the steel or concrete or bond strength of steel to concrete. Packaging or forms damaged from any cause shall be immediately replaced or restored to original condition.
- The shipping package or form shall be clearly marked with a statement that the package contains high-strength prestressing steel, and the type of corrosion inhibitor used, including the date packaged.
- Prestressing steel for post-tensioning which is installed in members prior to placing and curing of the concrete, and which is not epoxy-coated, shall be continuously protected against rust or other results of corrosion, until grouted, by means of a corrosion inhibitor placed in the ducts or applied to the steel in the duct. The corrosion inhibitor shall conform to the provisions specified herein.
- When steam curing is used, prestressing steel for post-tensioning shall not be installed until the steam curing is completed.
- Water used for flushing ducts shall contain either quick lime (calcium oxide) or slaked lime (calcium hydroxide) in the amount of 0.01-kg/L. Compressed air used to blow out ducts shall be oil free.
- When prestressing steel for post-tensioning is installed in the ducts after completion of concrete curing, and if stressing and grouting are completed within 10 days after the installation of the prestressing steel, rust which may form during those 10 days will not be cause for rejection of the steel. Prestressing steel installed, tensioned, and grouted in this manner, all within 10 days, will not require the use of a corrosion inhibitor in the duct following installation of the prestressing steel. Prestressing steel installed as above but not grouted within 10 days shall be subject to all the requirements in this section pertaining to corrosion protection and rejection because of rust. The requirements in this section pertaining to tensioning and grouting within 10 days shall not apply to epoxy-coated prestressing steel strand.
- Any time prestressing steel for pretensioning is placed in the stressing bed and is exposed to the elements for more than 36 hours prior to encasement in concrete, adequate measures shall be taken by the Contractor, as approved by the Engineer, to protect the steel from contamination or corrosion.
- After final fabrication of the seven-wire prestressing steel strand, no electric welding of any form shall be performed on the prestressing steel. Whenever electric welding is performed on or near members containing prestressing steel, the welding ground shall be attached directly to the steel being welded.
- Pretensioned prestressing steel shall be cut off flush with the end of the member. For epoxy-coated prestressing steel, only abrasive saws shall be used to cut the steel. The exposed ends of the prestressing steel and a 25-mm strip of adjoining concrete shall be cleaned and painted. Cleaning shall be by wire brushing or abrasive blast cleaning to remove all dirt and residue on the metal or concrete surfaces. Immediately after cleaning, the surfaces shall be covered with one application of unthinned zinc-rich primer (organic vehicle type) conforming to the provisions in Section 91, "Paint," except that 2 applications shall be applied to surfaces which will not be covered by concrete or mortar. Aerosol cans shall not be used. The paint shall be thoroughly mixed at the time of application and shall be worked into any voids in the prestressing tendons.

The thirteenth paragraph in Section 50-1.08, "Prestressing," of the Standard Specifications is amended to read:

• Prestressing steel in pretensioned members shall not be cut or released until the concrete in the member has attained a compressive strength of not less than the value shown on the plans or 28 MPa, whichever is greater. In addition to these concrete strength requirements, when epoxy-coated prestressing steel strand is used, the steel shall not be cut or released until the temperature of the concrete surrounding the strand is less than 65°C, and falling.

The fifth paragraph in Section 50-1.10, "Samples for Testing," of the Standard Specifications is amended to read:

• The following samples of materials and tendons, selected by the Engineer from the prestressing steel at the plant or jobsite, shall be furnished by the Contractor to the Engineer well in advance of anticipated use:

For wire or bars, one 2-m long sample and for strand, one 1.5-m long sample, of each size shall be furnished for each heat or reel.
For epoxy-coated strand, one 1.5-m long sample of uncoated strand of each size shall be furnished for each reel.
If the prestressing tendon is a bar, one 2-m long sample shall be furnished and in addition, if couplers are to be used with the bar, two 1.25-m long samples of bar, equipped with one coupler and fabricated to fit the coupler, shall be furnished.

The second paragraph in Section 50-1.11, "Payment," of the Standard Specifications is amended to read:

• The contract lump sum prices paid for prestressing cast-in-place concrete of the types listed in the Engineer's Estimate shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all work involved in furnishing, placing, and tensioning the prestressing steel in cast-in-place concrete structures, complete in place, as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.

SECTION 51: CONCRETE STRUCTURES

Issue Date: December 31, 2001

The first and second paragraph in Section 51-1.06A, "Falsework Design and Drawings," of the Standard Specifications are amended to read:

• The Contractor shall submit to the Engineer working drawings and design calculations for falsework proposed for use at bridges. For bridges where the height of any portion of the falsework, as measured from the ground line to the soffit of the superstructure, exceeds 4.25 m; or where any individual falsework clear span length exceeds 4.85 m; or where provision for vehicular, pedestrian, or railroad traffic through the falsework is made; the drawings shall be signed by an engineer who is registered as a Civil Engineer in the State of California. Six sets of the working drawings and 2 copies of the design calculations shall be furnished. Additional working drawings and design calculations shall be submitted to the Engineer when specified in "Railroad Relations and Insurance" of the special provisions.

• The falsework drawings shall include details of the falsework erection and removal operations showing the methods and sequences of erection and removal and the equipment to be used. The details of the falsework erection and removal operations shall demonstrate the stability of all or any portions of the falsework during all stages of the erection and removal operations.

The seventh paragraph in Section 51-1.06A, "Falsework Design and Drawings," of the Standard Specifications is amended to read:

• In the event that several falsework plans are submitted simultaneously, or an additional plan is submitted for review before the review of a previously submitted plan has been completed, the Contractor shall designate the sequence in which the plans are to be reviewed. In such event, the time to be provided for the review of any plan in the sequence shall be not less than the review time specified above for that plan, plus 2 weeks for each plan of higher priority which is still under review. A falsework plan submittal shall consist of plans for a single bridge or portion thereof. For multi-frame bridges, each frame shall require a separate falsework plan submittal.

Section 51-1.06A, "Falsework Design and Drawings," of the Standard Specifications is amended by adding the following paragraphs:

• If structural composite lumber is proposed for use, the falsework drawings shall clearly identify the structural composite lumber members by grade (E value), species, and type. The Contractor shall provide technical data from the

manufacturer showing the tabulated working stress values of the composite lumber. The Contractor shall furnish a certificate of compliance as specified in Section 6-1.07, "Certificates of Compliance," for each delivery of structural composite lumber to the project site.

• For falsework piles with a calculated loading capacity greater than 900 kN, the falsework piles shall be designed by an engineer who is registered as either a Civil Engineer or a Geotechnical Engineer in the State of California, and the calculations shall be submitted to the Engineer.

The first paragraph in Section 51-1.06A(1), "Design Loads," of the Standard Specifications is amended to read:

• The design load for falsework shall consist of the sum of dead and live vertical loads, and an assumed horizontal load. The minimum total design load for any falsework, including members that support walkways, shall be not less than 4800 N/m^2 for the combined live and dead load regardless of slab thickness.

The eighth paragraph in Section 51-1.06A(1), "Design Loads," of the Standard Specifications is amended to read:

• In addition to the minimum requirements specified in this Section 51-1.06A, falsework for box girder structures with internal falsework bracing systems using flexible members capable of withstanding tensile forces only, shall be designed to include the vertical effects caused by the elongation of the flexible member and the design horizontal load combined with the dead and live loads imposed by concrete placement for the girder stems and connected bottom slabs. Falsework comprised of individual steel towers with bracing systems using flexible members capable of withstanding tensile forces only to resist overturning, shall be exempt from these additional requirements.

The third paragraph in Section 51-1.06B, "Falsework Construction," of the Standard Specifications is amended to read:

• When falsework is supported on piles, the piles shall be driven and the actual bearing value assessed in conformance with the provisions in Section 49, "Piling."

Section 51-1.06B, "Falsework Construction," of the Standard Specifications is amended by adding the following paragraphs:

• For falsework piles with a calculated loading capacity greater than 900 kN, the Contractor shall conduct dynamic monitoring of pile driving and conduct penetration and bearing analyses based on a wave equation analysis. These analyses shall be signed by an engineer who is registered as a Civil Engineer in the State of California and submitted to the Engineer prior to completion of falsework erection.

• Prior to the placement of falsework members above the stringers, the final bracing system for the falsework shall be installed.

Section 51-1.06C, "Removing Falsework," of the Standard Specifications is amended by adding the following paragraph:

• The falsework removal operation shall be conducted in such a manner that any portion of the falsework not yet removed remains in a stable condition at all times.

The sixth paragraph in Section 51-1.09, "Placing Concrete," of the Standard Specifications is amended to read:

• Vibrators used to consolidate concrete containing epoxy-coated bar reinforcement or epoxy-coated prestressing steel shall have a resilient covering to prevent damage to the epoxy-coating on the reinforcement or prestressing steel.

The table in the ninth paragraph of Section 51-1.12H(1), "Plain and Fabric Reinforced Elastomeric Bearing Pads," of the Standard Specifications is amended to read:

Tensile strength, percent	-15
Elongation at break, percent	-40; but not less than 300% total elongation of the material
Hardness, points	+10

Section 51-1.17, "Finishing Bridge Decks," of the Standard Specifications is amended by deleting the thirteenth and fourteenth paragraphs.

The fourteenth paragraph in Section 51-1.23, "Payment," of the Standard Specifications is amended by deleting "and injecting epoxy in cracks".

SECTION 52: REINFORCEMENT

Issue Date: December 31, 2001

The third paragraph in Section 52-1.04, "Inspection," of the Standard Specifications is amended to read:

• A Certificate of Compliance conforming to the provisions in Section 6-1.07, "Certificates of Compliance," shall also be furnished for each shipment of epoxy-coated bar reinforcement or wire reinforcement certifying that the coated reinforcement conforms to the requirements in ASTM Designation: A 775/A 775M or A 884/A 884M, respectively, and the provisions in Section 52-1.02B, "Epoxy-coated Reinforcement." The Certificate of Compliance shall include all of the certifications specified in ASTM Designation: A 775/A 775M or A 884/A 884M respectively, and a statement that the coating material has been prequalified by acceptance testing performed by the Valley Forge Laboratories, Inc., Devon, Pennsylvania.

The third paragraph in Section 52-1.08C, "Mechanical Butt Splices," of the Standard Specifications is amended to read:

• The total slip of the reinforcing bars within the splice sleeve after loading in tension to 200 MPa and relaxing to 20 MPa shall not exceed the values listed in the following table. The slip shall be measured between gage points that are clear of the splice sleeve.

Reinforcing Bar Number	Total Slip (μm)
13	250
16	250
19	250
22	350
25	350
29	350
32	450
36	450
43	600
57	750

The first paragraph in Section 52-1.08C(5), "Sleeve-Lockshear Bolt Mechanical Butt Splices," of the Standard Specifications is amended to read:

• The sleeve-lockshear bolt type of mechanical butt splices shall consist of a seamless steel sleeve, center hole with centering pin, and bolts that are tightened until the bolt heads shear off with the bolt ends left embedded in the reinforcing bars. The seamless steel sleeve shall be either formed into a V configuration or shall have 2 serrated steel strips welded to the inside of the sleeve.

Section 52-1.08F, "Nondestructive Splice Tests," of the Standard Specifications is amended by deleting the seventh paragraph.

SECTION 55: STEEL STRUCTURES

Issue Date: December 31, 2001

Section 55-3.14, "Bolted Connections," of the Standard Specifications is amended by adding the following after the ninth paragraph:

• If a torque multiplier is used in conjunction with a calibrated wrench as a method for tightening fastener assemblies to the required tension, both the multiplier and the wrench shall be calibrated together as a system. The same length input and output sockets and extensions that will be used in the work shall also be included in the calibration of the system. The manufacturer's torque multiplication ratio shall be adjusted during calibration of the system, such that when this adjusted ratio

is multiplied by the actual input calibrated wrench reading, the product is a calculated output torque that is within 2 percent of the true output torque. When this system is used in the work to perform any installation tension testing, rotational capacity testing, fastener tightening, or tension verification, it shall be used, intact as calibrated.

The sixth paragraph of Section 55-4.02, "Payment," of the Standard Specifications is amended to read:

- If a portion or all of the structural steel is fabricated more than 480 air line kilometers from both Sacramento and Los Angeles, additional shop inspection expenses will be sustained by the State. Whereas it is and will be impracticable and extremely difficult to ascertain and determine the actual increase in these expenses, it is agreed that payment to the Contractor for furnishing the structural steel from each fabrication site located more than 480 air line kilometers from both Sacramento and Los Angeles will be reduced $5000 or by an amount computed at $0.044 per kilogram of structural steel fabricated, whichever is greater, or in the case of each fabrication site located more than 4800 air line kilometers from both Sacramento and Los Angeles, payment will be reduced $8000 or by $0.079 per kilogram of structural steel fabricated, whichever is greater.

SECTION 56: SIGNS

Issue Date: December 31, 2001

Section 56-1.01, "Description," of the Standard Specifications is amended by deleting the third paragraph.

The sixth through the thirteenth paragraphs in Section 56-1.03, "Fabrication," of the Standard Specifications are amended to read:

- High-strength bolted connections, where shown on the plans, shall conform to the provisions in Section 55-3.14, "Bolted Connections," except that only fastener assemblies consisting of a high-strength bolt, nut, hardened washer, and direct tension indicator shall be used.
- High-strength fastener assemblies, and any other bolts, nuts, and washers attached to sign structures shall be zinc-coated by the mechanical deposition process.
- An alternating snugging and tensioning pattern for anchor bolts and high-strength bolted splices shall be used. Once tensioned, high-strength fastener components and direct tension indicators shall not be reused.
- For bolt diameters less than 10 mm, the diameter of the bolt hole shall be not more than 0.80-mm larger than the nominal bolt diameter. For bolt diameters greater than or equal to 10 mm, the diameter of the bolt hole shall be not more than 1.6 mm larger than the nominal bolt diameter.
- Sign structures shall be fabricated into the largest practical sections prior to galvanizing.
- Ribbed sheet metal panels for box beam closed truss sign structures shall be fastened to the truss members by cap screws or bolts as shown on the plans, or by 4.76 mm stainless steel blind rivets conforming to Industrial Fasteners Institute, Standard IFI-114, Grade 51. The outside diameter of the large flange rivet head shall be not less than 15.88 mm in diameter. Web splices in ribbed sheet metal panels may be made with similar type blind rivets of a size suitable for the thickness of material being connected.
- Spalling or chipping of concrete structures shall be repaired by the Contractor at the Contractor's expense.
- Overhead sign supports shall have an aluminum identification plate permanently attached near the base, adjacent to the traffic side on one of the vertical posts, using either stainless steel rivets or stainless steel screws. As a minimum, the information on the plate shall include the name of the manufacturer, the date of manufacture and the contract number.

SECTION 59: PAINTING

Issue Date: December 31, 2001

Section 59-2.01, "General," of the Standard Specifications is amended by adding the following paragraphs after the first paragraph:

- Unless otherwise specified, no painting Contractors or subcontractors will be permitted to commence work without having the following current "SSPC: The Society for Protective Coatings" (formerly the Steel Structures Painting Council) certifications in good standing:

A. For cleaning and painting structural steel in the field, certification in conformance with the requirements in Qualification Procedure No. 1, "Standard Procedure For Evaluating Painting Contractors (Field Application to Complex Industrial Structures)" (SSPC-QP 1).
B. For removing paint from structural steel, certification in conformance with the requirements in Qualification Procedure No. 2, "Standard Procedure For Evaluating Painting Contractors (Field Removal of Hazardous Coatings from Complex Structures)" (SSPC-QP 2).
C. For cleaning and painting structural steel in a permanent painting facility, certification in conformance with the requirements in Qualification Procedure No. 3, "Standard Procedure For Evaluating Qualifications of Shop Painting Applicators" (SSPC-QP 3). The AISC's Sophisticated Paint Endorsement (SPE) quality program will be considered equivalent to SSPC-QP 3.

The third paragraph of Section 59-2.03, "Blast Cleaning," of the Standard Specifications is amended to read:

• Exposed steel or other metal surfaces to be blast cleaned shall be cleaned in conformance with the requirements in Surface Preparation Specification No. 6, "Commercial Blast Cleaning," of the "SSPC: The Society for Protective Coatings." Blast cleaning shall leave all surfaces with a dense, uniform, angular anchor pattern of not less than 35 µm as measured in conformance with the requirements in ASTM Designation: D 4417.

The first paragraph of Section 59-2.06, "Hand Cleaning," of the Standard Specifications is amended to read:

• Dirt, loose rust and mill scale, or paint which is not firmly bonded to the surfaces shall be removed in conformance with the requirements in Surface Preparation Specification No. 2, "Hand Tool Cleaning," of the "SSPC: The Society for Protective Coatings." Edges of old remaining paint shall be feathered.

The fourth paragraph of Section 59-2.12, "Painting," of the Standard Specifications is amended to read:

• The dry film thickness of the paint will be measured in place with a calibrated Type 2 magnetic film thickness gage in conformance with the requirements of specification SSPC-PA2 of the "SSPC: The Society for Protective Coatings."

SECTION 75: MISCELLANEOUS METAL

Issue Date: December 31, 2001

The table in the tenth paragraph of Section 75-1.02, "Miscellaneous Iron and Steel," of the Standard Specifications is amended to read:

Material	Specification
Steel bars, plates and shapes	ASTM Designation: A 36/A 36M or A 575, A 576 (AISI or M Grades 1016 through 1030 except Grade 1017)
Steel fastener components for general applications:	
Bolts and studs	ASTM Designation: A 307
Headed anchor bolts	ASTM Designation: A 307, Grade B, including S1 supplementary requirements
Nonheaded anchor bolts	ASTM Designation: A 307, Grade C, including S1 supplementary requirements and S1.6 of AASHTO Designation: M 314 supplementary requirements or AASHTO Designation: M 314, Grade 36 or 55, including S1 supplementary requirements
High-strength bolts and studs, threaded rods, and nonheaded anchor bolts	ASTM Designation: A 449, Type 1
Nuts	ASTM Designation: A 563, including Appendix X1*
Washers	ASTM Designation: F 844
Components of high-strength steel fastener assemblies for use in structural steel joints:	
Bolts	ASTM Designation: A 325, Type 1
Tension control bolts	ASTM Designation: F 1852, Type 1
Nuts	ASTM Designation: A 563, including Appendix X1*
Hardened washers	ASTM Designation: F 436, Type 1, Circular, including S1 supplementary requirements
Direct tension indicators	ASTM Designation: F 959, Type 325, zinc-coated
Stainless steel fasteners (Alloys 304 & 316) for general applications:	
Bolts, screws, studs, threaded rods, and nonheaded anchor bolts	ASTM Designation: F 593 or F 738M
Nuts	ASTM Designation: F 594 or F 836M
Washers	ASTM Designation: A 240/A 240M and ANSI B 18.22M
Carbon-steel castings	ASTM Designation: A 27/A 27M, Grade 65-35 [450-240], Class 1
Malleable iron castings	ASTM Designation: A 47, Grade 32510 or A 47M, Grade 22010
Gray iron castings	ASTM Designation: A 48, Class 30B
Ductile iron castings	ASTM Designation: A 536, Grade 65-45-12
Cast iron pipe	Commercial quality
Steel pipe	Commercial quality, welded or extruded
Other parts for general applications	Commercial quality

* Zinc-coated nuts that will be tightened beyond snug or wrench tight shall be furnished with a dyed dry lubricant conforming to Supplementary Requirement S2 in ASTM Designation: A 563.

The table in the eighteenth paragraph of Section 75-1.03, "Miscellaneous Bridge Metal," of the Standard Specifications is amended to read:

Stud Diameter (millimeters)	Sustained Tension Test Load (kilonewtons)
29.01-33.00	137.9
23.01-29.00	79.6
21.01-23.00	64.1
* 18.01-21.00	22.2
15.01-18.00	18.2
12.01-15.00	14.2
9.01-12.00	9.34
6.00-9.00	4.23

* Maximum stud diameter permitted for mechanical expansion anchors.

The table in the nineteenth paragraph of Section 75-1.03, "Miscellaneous Bridge Metal," of the Standard Specifications is amended to read:

Stud Diameter (millimeters)	Ultimate Tensile Load (kilonewtons)
30.01-33.00	112.1
27.01-30.00	88.1
23.01-27.00	71.2
20.01-23.00	51.6
16.01-20.00	32.0
14.01-16.00	29.4
12.00-14.00	18.7

The table in the twenty-second paragraph of Section 75-1.03, "Miscellaneous Bridge Metal," of the Standard Specifications is amended to read:

Installation Torque Values, (newton meters)

Stud Diameter (millimeters)	Shell Type Mechanical Expansion Anchors	Integral Stud Type Mechanical Expansion Anchors	Resin Capsule Anchors and Cast-in-Place Inserts
29.01-33.00	—	—	540
23.01-29.00	—	—	315
21.01-23.00	—	—	235
18.01-21.00	110	235	200
15.01-18.00	45	120	100
12.01-15.00	30	65	40
9.01-12.00	15	35	24
6.00-9.00	5	10	—

SECTION 83: RAILINGS AND BARRIERS

Issue Date: June 13, 2002

The ninth paragraph in Section 83-1.02B, "Metal Beam Guard Railing," of the Standard Specifications is amended to read:

• The grades and species of wood posts and blocks shall be No. 1 timbers (also known as No. 1 structural) Douglas fir or No. 1 timbers Southern yellow pine. Wood posts and blocks shall be graded in conformance with the provisions in Section 57-2, "Structural Timber," of the Standard Specifications, except allowances for shrinkage after mill cutting shall in no case exceed 5 percent of the American Lumber Standards minimum sizes, at the time of installation.

The eleventh paragraph in Section 83-1.02B, "Metal Beam Guard Railing," of the Standard Specifications is amended to read:

• Wood posts and blocks shall be pressure treated after fabrication in conformance with the provisions in Section 58, "Preservative Treatment of Lumber, Timber and Piling," of the Standard Specifications with creosote, creosote coal tar solution, creosote petroleum solution (50-50), pentachlorophenol in hydrocarbon solvent, copper naphthenate, ammoniacal copper arsenate, or ammoniacal copper zinc arsenate. In addition to the preservatives listed above, Southern yellow pine may also be pressure treated with chromated copper arsenate. When other than one of the creosote processes is used, blocks shall have a minimum retention of 6.4 Kg/m^3, and need not be incised.

SECTION 86: SIGNALS, LIGHTING AND ELECTRICAL SYSTEMS

Issue Date: February 28, 2002

The seventh paragraph of Section 86-2.03, "Foundations," of the Standard Specifications is amended to read:

• Forms shall be true to line and grade. Tops of foundations for posts and standards, except special foundations, shall be finished to curb or sidewalk grade or as directed by the Engineer. Forms shall be rigid and securely braced in place. Conduit ends and anchor bolts shall be placed in proper position and to proper height, and anchor bolts shall be held in place by means of rigid templates. Anchor bolts shall not be installed more than 1:40 from vertical.

The twelfth paragraph of Section 86-2.03, "Foundations," of the Standard Specifications is amended to read:

• Plumbing of the standards shall be accomplished by adjusting the leveling nuts before placing the mortar or before the foundation is finished to final grade. Shims, or other similar devices shall not be used for plumbing or raking of posts, standards or pedestals. After final adjustments of both top nuts and leveling nuts on anchorage assemblies have been made, firm contact shall exist between all bearing surfaces of the anchor bolt nuts, washers, and the base plate.

Section 86-8.01, "Payment," of the Standard Specifications is amended to read by adding the following paragraph after the first paragraph:

• If a portion or all of the traffic signal and lighting standards, pursuant to Standard Specification Section 86, "Signals, Lighting and Electrical Systems," are fabricated more than 480 air line kilometers from both Sacramento and Los Angeles, additional shop inspection expenses will be sustained by the State. Whereas it is and will be impracticable and extremely difficult to ascertain and determine the actual increase in such expenses, it is agreed that payment to the Contractor for furnishing such items from each fabrication site located more than 480 air line kilometers from both Sacramento and Los Angeles will be reduced $5000; in addition, in the case where a fabrication site is located more than 4800 air line kilometers from both Sacramento and Los Angeles, payment will be reduced an additional $3000 per each fabrication site ($8000 total per site).

SECTION 88: ENGINEERING FABRIC

Issue Date: January 15, 2002

Section 88-1.02, "Pavement Reinforcing Fabric," of the Standard Specifications is amended to read:

• Pavement reinforcing fabric shall be 100 percent polypropylene staple fiber fabric material, needle-punched, thermally bonded on one side, and conform to the following:

Specification	Requirement
Weight, grams per square meter ASTM Designation: D 5261	140
Grab tensile strength (25-mm grip), kilonewtons, min. in each direction ASTM Designation: D 4632	0.45
Elongation at break, percent min. ASTM Designation: D 4632	50
Asphalt retention by fabric, grams per square meter. (Residual Minimum) ASTM Designation: D 6140	900

Note: Weight, grab, elongation and asphalt retention are based on Minimum Average Roll Value (MARV)

SECTION 90: PORTLAND CEMENT CONCRETE

Issue Date: March 12, 2002

Section 90, "Portland Cement Concrete," of the Standard Specifications is amended to read:

SECTION 90: PORTLAND CEMENT CONCRETE
90-1 GENERAL

90-1.01 DESCRIPTION

• Portland cement concrete shall be composed of cementitious material, fine aggregate, coarse aggregate, admixtures if used, and water, proportioned and mixed as specified in these specifications.

• The Contractor shall determine the mix proportions for all concrete except pavement concrete. The Engineer will determine the mix proportions for pavement concrete. Concrete for which the mix proportions are determined either by the Contractor or the Engineer shall conform to the requirements of this Section 90.

• Unless otherwise specified, cementitious material shall be a combination of cement and mineral admixture. Cementitious material shall be either:

1. "Type IP (MS) Modified" cement; or
2. A combination of "Type II Modified" portland cement and mineral admixture; or
3. A combination of Type V portland cement and mineral admixture.

• Type III portland cement shall be used only as allowed in the special provisions or with the approval of the Engineer.

• Class 1 concrete shall contain not less than 400 kg of cementitious material per cubic meter.

• Class 2 concrete shall contain not less than 350 kg of cementitious material per cubic meter.

• Class 3 concrete shall contain not less than 300 kg of cementitious material per cubic meter.

• Class 4 concrete shall contain not less than 250 kg of cementitious material per cubic meter.

• Minor concrete shall contain not less than 325 kg of cementitious material per cubic meter unless otherwise specified in these specifications or the special provisions.

• Unless otherwise designated on the plans or specified in these specifications or the special provisions, the amount of cementitious material used per cubic meter of concrete in structures or portions of structures shall conform to the following:

Use	Cementitious Material Content (kg/m3)
Concrete designated by compressive strength:	
Deck slabs and slab spans of bridges	400 min., 475 max.
Roof sections of exposed top box culverts	400 min., 475 max.
Other portions of structures	350 min., 475 max.
Concrete not designated by compressive strength:	
Deck slabs and slab spans of bridges	400 min.
Roof sections of exposed top box culverts	400 min.
Prestressed members	400 min.
Seal courses	400 min.
Other portions of structures	350 min.
Concrete for precast members	350 min., 550 max.

• Whenever the 28-day compressive strength shown on the plans is greater than 25 MPa, the concrete shall be designated by compressive strength. If the plans show a 28-day compressive strength that is 28 MPa or greater, an additional 14 days will be allowed to obtain the specified strength. The 28-day compressive strengths shown on the plans that are 25 MPa or less are shown for design information only and are not a requirement for acceptance of the concrete.

• Concrete designated by compressive strength shall be proportioned such that the concrete will attain the strength shown on the plans or specified in the special provisions.

• Before using concrete for which the mix proportions have been determined by the Contractor, or in advance of revising those mix proportions, the Contractor shall submit in writing to the Engineer a copy of the mix design.

• Compliance with cementitious material content requirements will be verified in conformance with procedures described in California Test 518 for cement content. For testing purposes, mineral admixture shall be considered to be cement. Batch proportions shall be adjusted as necessary to produce concrete having the specified cementitious material content.

• If any concrete has a cementitious material, portland cement, or mineral admixture content that is less than the minimum required, the concrete shall be removed. However, if the Engineer determines that the concrete is structurally adequate, the concrete may remain in place and the Contractor shall pay to the State $0.55 for each kilogram of cementitious material, portland cement, or mineral admixture that is less than the minimum required. The Department may deduct the amount from any moneys due, or that may become due, the Contractor under the contract. The deductions will not be made unless the difference between the contents required and those actually provided exceeds the batching tolerances permitted by Section 90-5, "Proportioning." No deductions will be made based on the results of California Test 518.

• The requirements of the preceding paragraph shall not apply to minor concrete or commercial quality concrete.

90-2 MATERIALS

90-2.01 CEMENT

• Unless otherwise specified, cement shall be either "Type IP (MS) Modified" cement, "Type II Modified" portland cement or Type V portland cement.

• "Type IP (MS) Modified" cement shall conform to the requirements for Type IP (MS) cement in ASTM Designation: C 595, and shall be comprised of an intimate and uniform blend of Type II cement and not more than 35 percent by mass of mineral admixture. The type and minimum amount of mineral admixture used in the manufacture of "Type IP (MS) Modified" cement shall be in conformance with the provisions in Section 90-4.08, "Required Use of Mineral Admixtures."

• "Type II Modified" portland cement shall conform to the requirements for Type II portland cement in ASTM Designation: C 150.

• In addition, "Type IP (MS) Modified" cement and "Type II Modified" portland cement shall conform to the following requirements:

A. The cement shall not contain more than 0.60 percent by mass of alkalies, calculated as the percentage of Na_2O plus 0.658 times the percentage of K_2O, when determined by either direct intensity flame photometry or by the atomic absorption method. The instrument and procedure used shall be qualified as to precision and accuracy in conformance with the requirements in ASTM Designation: C 114;
B. The autoclave expansion shall not exceed 0.50 percent; and
C. Mortar, containing the cement to be used and Ottawa sand, when tested in conformance with California Test 527, shall not expand in water more than 0.010 percent and shall not contract in air more than 0.048 percent, except that

when cement is to be used for precast prestressed concrete piling, precast prestressed concrete members, or steam cured concrete products, the mortar shall not contract in air more than 0.053 percent.

- Type III and Type V portland cements shall conform to the requirements in ASTM Designation: C 150 and the additional requirements listed above for "Type II Modified" portland cement, except that when tested in conformance with California Test 527, mortar containing Type III portland cement shall not contract in air more than 0.075 percent.
- Cement used in the manufacture of cast-in-place concrete for exposed surfaces of like elements of a structure shall be from the same cement mill.
- Cement shall be protected from exposure to moisture until used. Sacked cement shall be piled to permit access for tally, inspection, and identification of each shipment.
- Adequate facilities shall be provided to assure that cement meeting the provisions specified in this Section 90-2.01 shall be kept separate from other cement in order to prevent any but the specified cement from entering the work. Safe and suitable facilities for sampling cement shall be provided at the weigh hopper or in the feed line immediately in advance of the hopper, in conformance with California Test 125.
- If cement is used prior to sampling and testing as provided in Section 6-1.07, "Certificates of Compliance," and the cement is delivered directly to the site of the work, the Certificate of Compliance shall be signed by the cement manufacturer or supplier of the cement. If the cement is used in ready-mixed concrete or in precast concrete products purchased as such by the Contractor, the Certificate of Compliance shall be signed by the manufacturer of the concrete or product.
- Cement furnished without a Certificate of Compliance shall not be used in the work until the Engineer has had sufficient time to make appropriate tests and has approved the cement for use.

90-2.02 AGGREGATES

- Aggregates shall be free from deleterious coatings, clay balls, roots, bark, sticks, rags, and other extraneous material.
- Natural aggregates shall be thoroughly and uniformly washed before use.
- The Contractor, at the Contractor's expense, shall provide safe and suitable facilities, including necessary splitting devices for obtaining samples of aggregates, in conformance with California Test 125.
- Aggregates shall be of such character that it will be possible to produce workable concrete within the limits of water content provided in Section 90-6.06, "Amount of Water and Penetration."
- Aggregates shall have not more than 10 percent loss when tested for soundness in conformance with the requirements in California Test 214. The soundness requirement for fine aggregate will be waived, provided that the durability index, D_f, of the fine aggregate is 60, or greater, when tested for durability in conformance with California Test 229.
- If the results of any one or more of the Cleanness Value, Sand Equivalent, or aggregate grading tests do not meet the requirements specified for "Operating Range" but all meet the "Contract Compliance" requirements, the placement of concrete shall be suspended at the completion of the current pour until tests or other information indicate that the next material to be used in the work will comply with the requirements specified for "Operating Range."
- If the results of either or both the Cleanness Value and coarse aggregate grading tests do not meet the requirements specified for "Contract Compliance," the concrete that is represented by the tests shall be removed. However, if the Engineer determines that the concrete is structurally adequate, the concrete may remain in place, and the Contractor shall pay to the State $4.60 per cubic meter for paving concrete and $7.20 per cubic meter for all other concrete for the concrete represented by these tests and left in place. The Department may deduct the amount from any moneys due, or that may become due, the Contractor under the contract.
- If the results of either or both the Sand Equivalent and fine aggregate grading tests do not meet the requirements specified for "Contract Compliance," the concrete which is represented by the tests shall be removed. However, if the Engineer determines that the concrete is structurally adequate, the concrete may remain in place, and the Contractor shall pay to the State $4.60 per cubic meter for paving concrete and $7.20 per cubic meter for all other concrete for the concrete represented by these tests and left in place. The Department may deduct the amount from any moneys due, or that may become due, the Contractor under the contract.
- The 2 preceding paragraphs apply individually to the "Contract Compliance" requirements for coarse aggregate and fine aggregate. When both coarse aggregate and fine aggregate do not conform to the "Contract Compliance" requirements, both paragraphs shall apply. The payments specified in those paragraphs shall be in addition to any payments made in conformance with the provisions in Section 90-1.01, "Description."
- No single Cleanness Value, Sand Equivalent or aggregate grading test shall represent more than 250 m^3 of concrete or one day's pour, whichever is smaller.
- Aggregates specified for freeze-thaw resistance shall pass the freezing and thawing test, California Test 528.
- The Contractor shall notify the Engineer of the proposed source of freeze-thaw resistant concrete aggregates at least 4 months before intended use. Should the Contractor later propose a different source of concrete aggregates, the Contractor shall again notify the Engineer at least 4 months before intended use. Blending of fine or coarse aggregates from untested

sources with acceptable aggregates will not be permitted. Provisions for the time of submission of samples as provided in Section 40-1.015, "Cement Content," are superseded by the foregoing.

• Concurrently with notification of proposed sources of freeze-thaw resistant concrete aggregates, the Contractor shall furnish samples in the quantity ordered by the Engineer. The samples shall be secured under the direct supervision of the Engineer. Samples from existing stockpiles of processed aggregate shall be taken from washed materials and shall be visibly damp. Samples from materials in place in a material source shall be taken at depths from the existing surface that will ensure the presence of the full quantity of ground water. Excavations for the purpose of securing samples shall be made to the full depth of intended source operations. Samples shall be protected against loss of contained water until they are delivered to the Engineer.

• The Engineer will waive the above freeze-thaw test and the 4-month advance notice, required in this Section, provided aggregates are to be obtained from sources that have previously passed this test and test results are currently applicable.

• No extension of contract time will be allowed for the time required to perform the freezing and thawing test.

• When the source of an aggregate is changed, except for pavement concrete, the Contractor shall adjust the mix proportions and submit in writing to the Engineer a copy of the mix design before using the aggregates. When the source of an aggregate is changed for pavement concrete, the Engineer shall be allowed sufficient time to adjust the mix, and the aggregates shall not be used until necessary adjustments are made.

90-2.02A Coarse Aggregate

• Coarse aggregate shall consist of gravel, crushed gravel, crushed rock, crushed air-cooled iron blast furnace slag or combinations thereof. Crushed air-cooled blast furnace slag shall not be used in reinforced or prestressed concrete.

• Coarse aggregate shall conform to the following quality requirements:

Tests	California Test	Requirements
Loss in Los Angeles Rattler (after 500 revolutions)	211	45% max.
Cleanness Value		
Operating Range	227	75 min.
Contract Compliance	227	71 min.

• In lieu of the above Cleanness Value requirements, a Cleanness Value "Operating Range" limit of 71, minimum, and a Cleanness Value "Contract Compliance" limit of 68, minimum, will be used to determine the acceptability of the coarse aggregate if the Contractor furnishes a Certificate of Compliance, as provided in Section 6-1.07, "Certificates of Compliance," certifying that:

1. coarse aggregate sampled at the completion of processing at the aggregate production plant had a Cleanness Value of not less than 82 when tested by California Test 227; and
2. prequalification tests performed in conformance with the requirements in California Test 549 indicated that the aggregate would develop a relative strength of not less than 95 percent and would have a relative shrinkage not greater than 105 percent, based on concrete.

90-2.02B Fine Aggregate

• Fine aggregate shall consist of natural sand, manufactured sand produced from larger aggregate or a combination thereof. Manufactured sand shall be well graded.

• Fine aggregate shall conform to the following quality requirements:

Test	California Test	Requirements
Organic Impurities	213	Satisfactory[a]
Mortar Strengths Relative to Ottawa Sand	515	95%, min.
Sand Equivalent:		
Operating Range	217	75, min.
Contract Compliance	217	71, min.

a Fine aggregate developing a color darker than the reference standard color solution may be accepted if it is determined by the Engineer, from mortar strength tests, that a darker color is acceptable.

• In lieu of the above Sand Equivalent requirements, a Sand Equivalent "Operating Range" limit of 71 minimum and a Sand Equivalent "Contract Compliance" limit of 68 minimum will be used to determine the acceptability of the fine aggregate if the Contractor furnishes a Certificate of Compliance, as provided in Section 6-1.07, "Certificates of Compliance," certifying that:

1. fine aggregate sampled at the completion of processing at the aggregate production plant had a Sand Equivalent value of not less than 82 when tested by California Test 217; and
2. prequalification tests performed in conformance with California Test 549 indicated that the aggregate would develop a relative strength of not less than 95 percent and would have a relative shrinkage not greater than 105 percent, based on concrete.

90-2.03 WATER

• In conventionally reinforced concrete work, the water for curing, for washing aggregates, and for mixing shall be free from oil and shall not contain more than 1000 parts per million of chlorides as Cl, when tested in conformance with California Test 422, nor more than 1300 parts per million of sulfates as SO_4, when tested in conformance with California Test 417. In prestressed concrete work, the water for curing, for washing aggregates, and for mixing shall be free from oil and shall not contain more than 650 parts per million of chlorides as Cl, when tested in conformance with California Test 422, nor more than 1300 parts per million of sulfates as SO_4, when tested in conformance with California Test 417. In no case shall the water contain an amount of impurities that will cause either: 1) a change in the setting time of cement of more than 25 percent when tested in conformance with the requirements in ASTM Designation: C 191 or ASTM Designation: C 266 or 2) a reduction in the compressive strength of mortar at 14 days of more than 5 percent, when tested in conformance with the requirements in ASTM Designation: C 109, when compared to the results obtained with distilled water or deionized water, tested in conformance with the requirements in ASTM Designation: C 109.

• In non-reinforced concrete work, the water for curing, for washing aggregates and for mixing shall be free from oil and shall not contain more than 2000 parts per million of chlorides as Cl, when tested in conformance with California Test 422, or more than 1500 parts per million of sulfates as SO_4, when tested in conformance with California Test 417.

• In addition to the above provisions, water for curing concrete shall not contain impurities in a sufficient amount to cause discoloration of the concrete or produce etching of the surface.

• Water reclaimed from mixer wash-out operations may be used in mixing concrete. The water shall not contain coloring agents or more than 300 parts per million of alkalis ($Na_2O + 0.658\ K_2O$) as determined on the filtrate. The specific gravity of the water shall not exceed 1.03 and shall not vary more than ±0.010 during a day's operations.

90-2.04 ADMIXTURE MATERIALS

• Admixture materials shall conform to the requirements in the following ASTM Designations:

A. Chemical Admixtures—ASTM Designation: C 494.
B. Air-entraining Admixtures—ASTM Designation: C 260.
C. Calcium Chloride—ASTM Designation: D 98.
D. Mineral Admixtures—Coal fly ash; raw or calcined natural pozzolan as specified in ASTM Designation: C618; silica fume conforming to the requirements in ASTM Designation: C1240, with reduction of mortar expansion of 80 percent, minimum, using the cement from the proposed mix design.

• Unless otherwise specified in the special provisions, mineral admixtures shall be used in conformance with the provisions in Section 90-4.08, "Required Use of Mineral Admixtures."

90-3 AGGREGATE GRADINGS

90-3.01 GENERAL

• Before beginning concrete work, the Contractor shall submit in writing to the Engineer the gradation of the primary aggregate nominal sizes that the Contractor proposes to furnish. If a primary coarse aggregate or the fine aggregate is separated into 2 or more sizes, the proposed gradation shall consist of the gradation for each individual size, and the proposed proportions of each individual size, combined mathematically to indicate one proposed gradation. The proposed gradation shall meet the grading requirements shown in the table in this section, and shall show the percentage passing each of the sieve sizes used in determining the end result.

• The Engineer may waive, in writing, the gradation requirements in this Section 90-3.01 and in Sections 90-3.02, "Coarse Aggregate Grading," 90-3.03, "Fine Aggregate Grading," and 90-3.04, "Combined Aggregate Gradings," if, in the Engineer's opinion, furnishing the gradation is not necessary for the type or amount of concrete work to be constructed.

• Gradations proposed by the Contractor shall be within the following percentage passing limits:

Primary Aggregate Nominal Size	Sieve Size	Limits of Proposed Gradation
37.5-mm x 19-mm	25-mm	19 - 41
25-mm x 4.75-mm	19-mm	52 - 85
25-mm x 4.75-mm	9.5-mm	15 - 38
12.5-mm x 4.75-mm	9.5-mm	40 - 78
9.5-mm x 2.36-mm	9.5-mm	50 - 85
Fine Aggregate	1.18-mm	55 - 75
Fine Aggregate	600-µm	34 - 46
Fine Aggregate	300-µm	16 - 29

• Should the Contractor change the source of supply, the Contractor shall submit in writing to the Engineer the new gradations before their intended use.

90-3.02 COARSE AGGREGATE GRADING

• The grading requirements for coarse aggregates are shown in the following table for each size of coarse aggregate:

	Percentage Passing Primary Aggregate Nominal Sizes							
	37.5-mm x 19-mm		25-mm x 4.75-mm		12.5-mm x 4.75-mm		9.5-mm x 2.36-mm	
Sieve Sizes	Operating Range	Contract Compliance	Operating Range	Contract Compliance	Operating Range	Contract Compliance	Operating Range	Contract Compliance
50-mm	100	100	—	—	—	—	—	—
37.5-mm	88-100	85-100	100	100	—	—	—	—
25-mm	x ± 18	X ± 25	88-100	86-100	—	—	—	—
19-mm	0-17	0-20	X ± 15	X ± 22	100	100	—	—
12.5-mm	—	—	—	—	82-100	80-100	100	100
9.5-mm	0-7	0-9	X ± 15	X ± 22	X ± 15	X ± 22	X ± 15	X ± 20
4.75-mm	—	—	0-16	0-18	0-15	0-18	0-25	0-28
2.36-mm	—	—	0-6	0-7	0-6	0-7	0-6	0-7

• In the above table, the symbol X is the gradation that the Contractor proposes to furnish for the specific sieve size as provided in Section 90-3.01, "General."

• Coarse aggregate for the 37.5-mm, maximum, combined aggregate grading as provided in Section 90-3.04, "Combined Aggregate Gradings," shall be furnished in 2 or more primary aggregate nominal sizes. Each primary aggregate nominal size may be separated into 2 sizes and stored separately, provided that the combined material conforms to the grading requirements for that particular primary aggregate nominal size.

• When the 25-mm, maximum, combined aggregate grading as provided in Section 90-3.04, "Combined Aggregate Gradings," is to be used, the coarse aggregate may be separated into 2 sizes and stored separately, provided that the combined material shall conform to the grading requirements for the 25-mm x 4.75-mm primary aggregate nominal size.

90-3.03 FINE AGGREGATE GRADING

- Fine aggregate shall be graded within the following limits:

Sieve Sizes	Percentage Passing	
	Operating Range	Contract Compliance
9.5-mm	100	100
4.75-mm	95-100	93-100
2.36-mm	65-95	61-99
1.18-mm	X ± 10	X ± 13
600-µm	X ± 9	X ± 12
300-µm	X ± 6	X ± 9
150-µm	2-12	1-15
75-µm	0-8	0-10

- In the above table, the symbol X is the gradation that the Contractor proposes to furnish for the specific sieve size as provided in Section 90-3.01, "General."
- In addition to the above required grading analysis, the distribution of the fine aggregate sizes shall be such that the difference between the total percentage passing the 1.18-mm sieve and the total percentage passing the 600-µm sieve shall be between 10 and 40, and the difference between the percentage passing the 600-µm and 300-µm sieves shall be between 10 and 40.
- Fine aggregate may be separated into 2 or more sizes and stored separately, provided that the combined material conforms to the grading requirements specified in this Section 90-3.03.

90-3.04 COMBINED AGGREGATE GRADINGS

- Combined aggregate grading limits shall be used only for the design of concrete mixes. Concrete mixes shall be designed so that aggregates are combined in proportions that shall produce a mixture within the grading limits for combined aggregates as specified herein. Within these limitations, the relative proportions shall be as ordered by the Engineer, except as otherwise provided in Section 90-1.01, "Description."
- The combined aggregate grading used in portland cement concrete pavement shall be the 37.5-mm, maximum grading.
- The combined aggregate grading used in concrete for structures and other concrete items, except when specified otherwise in these specifications or the special provisions, shall be either the 37.5-mm, maximum grading, or the 25-mm, maximum grading, at the option of the Contractor.

Grading Limits of Combined Aggregates

Sieve Sizes	Percentage Passing			
	37.5-mm Max.	25-mm Max.	12.5-mm Max.	9.5-mm Max.
50-mm	100	—	—	—
37.5-mm	90-100	100	—	—
25-mm	50-86	90-100	—	—
19-mm	45-75	55-100	100	—
12.5-mm	—	—	90-100	100
9.5-mm	38-55	45-75	55-86	50 - 100
4.75-mm	30-45	35-60	45-63	45 - 63
2.36-mm	23-38	27-45	35-49	35 - 49
1.18-mm	17-33	20-35	25-37	25 - 37
600-µm	10-22	12-25	15-25	15 - 25
300-µm	4-10	5-15	5-15	5 - 15
150-µm	1-6	1-8	1-8	1 - 8
75-µm	0-3	0-4	0-4	0 - 4

- Changes from one grading to another shall not be made during the progress of the work unless permitted by the Engineer.

90-4 ADMIXTURES

90-4.01 GENERAL

- Admixtures used in portland cement concrete shall conform to and be used in conformance with the provisions in this Section 90-4 and the special provisions. Admixtures shall be used when specified or ordered by the Engineer and may be used at the Contractor's option as provided herein.
- Chemical admixtures and air-entraining admixtures containing chlorides as Cl in excess of one percent by mass of admixture, as determined by California Test 415, shall not be used in prestressed or reinforced concrete.
- Calcium chloride shall not be used in concrete containing steel reinforcement or other embedded metals.
- Mineral admixture used in concrete for exposed surfaces of like elements of a structure shall be from the same source and of the same percentage.
- Admixtures shall be uniform in properties throughout their use in the work. Should it be found that an admixture as furnished is not uniform in properties, its use shall be discontinued.
- If more than one admixture is used, the admixtures shall be compatible with each other so that the desirable effects of all admixtures used will be realized.

90-4.02 MATERIALS

- Admixture materials shall conform to the provisions in Section 90–2.04, "Admixture Materials."

90-4.03 ADMIXTURE APPROVAL

- No admixture brand shall be used in the work unless it is on the Department's current list of approved brands for the type of admixture involved.
- Admixture brands will be considered for addition to the approved list if the manufacturer of the admixture submits to the Transportation Laboratory a sample of the admixture accompanied by certified test results demonstrating that the admixture complies with the requirements in the appropriate ASTM Designation and these specifications. The sample shall be sufficient to permit performance of all required tests. Approval of admixture brands will be dependent upon a determination as to compliance with the requirements, based on the certified test results submitted, together with tests the Department may elect to perform.
- When the Contractor proposes to use an admixture of a brand and type on the current list of approved admixture brands, the Contractor shall furnish a Certificate of Compliance from the manufacturer, as provided in Section 6-1.07, "Certificates of Compliance," certifying that the admixture furnished is the same as that previously approved. If a previously approved admixture is not accompanied by a Certificate of Compliance, the admixture shall not be used in the work until the Engineer has had sufficient time to make the appropriate tests and has approved the admixture for use. The Engineer may take samples for testing at any time, whether or not the admixture has been accompanied by a Certificate of Compliance.
- If a mineral admixture is delivered directly to the site of the work, the Certificate of Compliance shall be signed by the manufacturer or supplier of the mineral admixture. If the mineral admixture is used in ready-mix concrete or in precast concrete products purchased as such by the Contractor, the Certificate of Compliance shall be signed by the manufacturer of the concrete or product.

90-4.04 REQUIRED USE OF CHEMICAL ADMIXTURES AND CALCIUM CHLORIDE

- When the use of a chemical admixture or calcium chloride is specified or ordered by the Engineer, the admixture shall be used at the dosage specified or ordered, except that if no dosage is specified or ordered, the admixture shall be used at the dosage normally recommended by the manufacturer of the admixture.
- Calcium chloride shall be dispensed in liquid, flake, or pellet form. Calcium chloride dispensed in liquid form shall conform to the provisions for dispensing liquid admixtures in Section 90-4.10, "Proportioning and Dispensing Liquid Admixtures."

90-4.05 OPTIONAL USE OF CHEMICAL ADMIXTURES

- The Contractor will be permitted to use Type A or F, water-reducing; Type B, retarding; or Type D or G, water-reducing and retarding admixtures as described in ASTM Designation: C 494 to conserve cementitious material or to facilitate any concrete construction application subject to the following conditions:

A. When a water-reducing admixture or a water-reducing and retarding admixture is used, the cementitious material content specified or ordered may be reduced by a maximum of 5 percent by mass, except that the resultant cementitious material content shall be not less than 300 kilograms per cubic meter; and
B. When a reduction in cementitious material content is made, the dosage of admixture used shall be the dosage used in determining approval of the admixture.

• Unless otherwise specified, a Type C accelerating chemical admixture conforming to the requirements in ASTM Designation: C 494, may be used in portland cement concrete. Inclusion in the mix design submitted for approval will not be required provided that the admixture is added to counteract changing conditions that contribute to delayed setting of the portland cement concrete, and the use or change in dosage of the admixture is approved in writing by the Engineer.

90-4.06 REQUIRED USE OF AIR-ENTRAINING ADMIXTURES

• When air-entrainment is specified or ordered by the Engineer, the air-entraining admixture shall be used in amounts to produce a concrete having the specified air content as determined by California Test 504.

90-4.07 OPTIONAL USE OF AIR-ENTRAINING ADMIXTURES

• When air-entrainment has not been specified or ordered by the Engineer, the Contractor will be permitted to use an air-entraining admixture to facilitate the use of any construction procedure or equipment provided that the average air content, as determined by California Test 504, of 3 successive tests does not exceed 4 percent, and no single test value exceeds 5.5 percent. If the Contractor elects to use an air-entraining admixture in concrete for pavement, the Contractor shall so indicate at the time the Contractor designates the source of aggregate as provided in Section 40-1.015, "Cement Content."

90-4.08 REQUIRED USE OF MINERAL ADMIXTURES

• Unless otherwise specified, mineral admixture shall be combined with cement to make cementitious material.

• The calcium oxide content of mineral admixtures shall not exceed 10 percent and the available alkali, as sodium oxide equivalent, shall not exceed 1.5 percent when determined in conformance with the requirements in ASTM Designation: C 618.

• The amounts of cement and mineral admixture used in cementitious material shall be sufficient to satisfy the minimum cementitious material content requirements specified in Section 90-1.01, "Description," or Section 90-4.05, "Optional Use of Chemical Admixtures," and shall conform to the following:

A. The minimum amount of cement shall not be less than 75 percent by mass of the specified minimum cementitious material content;
B. The minimum amount of mineral admixture to be combined with cement shall be determined using one of the following criteria:

    1. When the calcium oxide content of a mineral admixture is equal to or less than 2 percent by mass, the amount of mineral admixture shall not be less than 15 percent by mass of the total amount of cementitious material to be used in the mix;
    2. When the calcium oxide content of a mineral admixture is greater than 2 percent, the amount of mineral admixture shall not be less than 25 percent by mass of the total amount of cementitious material to be used in the mix;
    3. When a mineral admixture that conforms to the provisions for silica fume in Section 90-2.04, "Admixture Materials," is used, the amount of mineral admixture shall not be less than 10 percent by mass of the total amount of cementitious material to be used in the mix

C. The total amount of mineral admixture shall not exceed 35 percent by mass of the total amount of cementitious material to be used in the mix. Where Section 90-1.01, "Description," specifies a maximum cementitious content in kilograms per cubic meter, the total mass of cement and mineral admixture per cubic meter shall not exceed the specified maximum cementitious material content.

90-4.09 BLANK

90-4.10 PROPORTIONING AND DISPENSING LIQUID ADMIXTURES

• Chemical admixtures and air-entraining admixtures shall be dispensed in liquid form. Dispensers for liquid admixtures shall have sufficient capacity to measure at one time the prescribed quantity required for each batch of concrete. Each dispenser shall include a graduated measuring unit into which liquid admixtures are measured to within ±5 percent of the prescribed quantity for each batch. Dispensers shall be located and maintained so that the graduations can be accurately read from the point at which proportioning operations are controlled to permit a visual check of batching accuracy prior to discharge. Each measuring unit shall be clearly marked for the type and quantity of admixture.

• Each liquid admixture dispensing system shall be equipped with a sampling device consisting of a valve located in a safe and readily accessible position such that a sample of the admixture may be withdrawn slowly by the Engineer.

• If more than one liquid admixture is used in the concrete mix, each liquid admixture shall have a separate measuring unit and shall be dispensed by injecting equipment located in such a manner that the admixtures are not mixed at high concentrations and do not interfere with the effectiveness of each other. When air-entraining admixtures are used in conjunction with other liquid admixtures, the air-entraining admixture shall be the first to be incorporated into the mix.

• When automatic proportioning devices are required for concrete pavement, dispensers for liquid admixtures shall operate automatically with the batching control equipment. The dispensers shall be equipped with an automatic warning system in good operating condition that will provide a visible or audible signal at the point at which proportioning operations are controlled when the quantity of admixture measured for each batch of concrete varies from the preselected dosage by more than 5 percent, or when the entire contents of the measuring unit are not emptied from the dispenser into each batch of concrete.

• Unless liquid admixtures are added to premeasured water for the batch, their discharge into the batch shall be arranged to flow into the stream of water so that the admixtures are well dispersed throughout the batch, except that air-entraining admixtures may be dispensed directly into moist sand in the batching bins provided that adequate control of the air content of the concrete can be maintained.

• Liquid admixtures requiring dosages greater than 2.5 L/m^3 shall be considered to be water when determining the total amount of free water as specified in Section 90-6.06, "Amount of Water and Penetration."

• Special admixtures, such as "high range" water reducers that may contribute to a high rate of slump loss, shall be measured and dispensed as recommended by the admixture manufacturer and as approved by the Engineer.

90-4.11 STORAGE, PROPORTIONING, AND DISPENSING OF MINERAL ADMIXTURES

• Mineral admixtures shall be protected from exposure to moisture until used. Sacked material shall be piled to permit access for tally, inspection and identification for each shipment.

• Adequate facilities shall be provided to assure that mineral admixtures meeting the specified requirements are kept separate from other mineral admixtures in order to prevent any but the specified mineral admixtures from entering the work. Safe and suitable facilities for sampling mineral admixtures shall be provided at the weigh hopper or in the feed line immediately in advance of the hopper.

• Mineral admixtures shall be incorporated into concrete using equipment conforming to the requirements for cement weigh hoppers, and charging and discharging mechanisms in ASTM Designation: C 94, in Section 90-5.03, "Proportioning," and in this Section 90-4.11.

• When concrete is completely mixed in stationary paving mixers, the mineral admixture shall be weighed in a separate weigh hopper conforming to the provisions for cement weigh hoppers and charging and discharging mechanisms in Section 90-5.03A, "Proportioning for Pavement," and the mineral admixture and cement shall be introduced simultaneously into the mixer proportionately with the aggregate. If the mineral admixture is not weighed in a separate weigh hopper, the Contractor shall provide certification that the stationary mixer is capable of mixing the cement, admixture, aggregates and water uniformly prior to discharge. Certification shall contain the following:

A. Test results for 2 compressive strength test cylinders of concrete taken within the first one-third and 2 compressive strength test cylinders of concrete taken within the last one-third of the concrete discharged from a single batch from the stationary paving mixer. Strength tests and cylinder preparation will be in conformance with the provisions of Section 90-9, "Compressive Strength;"
B. Calculations demonstrating that the difference in the averages of 2 compressive strengths taken in the first one-third is no greater than 7.5 percent different than the averages of 2 compressive strengths taken in the last one-third of the concrete discharged from a single batch from the stationary paving mixer. Strength tests and cylinder preparation will be in conformance with the provisions of Section 90-9, "Compressive Strength;" and
C. The mixer rotation speed and time of mixing prior to discharge that are required to produce a mix that meets the requirements above.

90-5 PROPORTIONING

90-5.01 STORAGE OF AGGREGATES

• Aggregates shall be stored or stockpiled in such a manner that separation of coarse and fine particles of each size shall be avoided and also that the various sizes shall not become intermixed before proportioning.

• Aggregates shall be stored or stockpiled and handled in a manner that shall prevent contamination by foreign materials. In addition, storage of aggregates at batching or mixing facilities that are erected subsequent to the award of the contract and that furnish concrete to the project shall conform to the following:

A. Intermingling of the different sizes of aggregates shall be positively prevented. The Contractor shall take the necessary measures to prevent intermingling. The preventive measures may include, but are not necessarily limited to, physical separation of stockpiles or construction of bulkheads of adequate length and height; and
B. Contamination of aggregates by contact with the ground shall be positively prevented. The Contractor shall take the necessary measures to prevent contamination. The preventive measures shall include, but are not necessarily limited to, placing aggregates on wooden platforms or on hardened surfaces consisting of portland cement concrete, asphalt concrete, or cement treated material.

• In placing aggregates in storage or in moving the aggregates from storage to the weigh hopper of the batching plant, any method that may cause segregation, degradation, or the combining of materials of different gradings that will result in any size of aggregate at the weigh hopper failing to meet the grading requirements, shall be discontinued. Any method of handling aggregates that results in excessive breakage of particles shall be discontinued. The use of suitable devices to reduce impact of falling aggregates may be required by the Engineer.

90-5.02 PROPORTIONING DEVICES

• Weighing, measuring, or metering devices used for proportioning materials shall conform to the requirements in Section 9-1.01, "Measurement of Quantities," and this Section 90-5.02. In addition, automatic weighing systems shall comply with the requirements for automatic proportioning devices in Section 90-5.03A, "Proportioning for Pavement." Automatic devices shall be automatic to the extent that the only manual operation required for proportioning the aggregates, cement, and mineral admixture for one batch of concrete is a single operation of a switch or starter.

• Proportioning devices shall be tested at the expense of the Contractor as frequently as the Engineer may deem necessary to ensure their accuracy.

• Weighing equipment shall be insulated against vibration or movement of other operating equipment in the plant. When the plant is in operation, the mass of each batch of material shall not vary from the mass designated by the Engineer by more than the tolerances specified herein.

• Equipment for cumulative weighing of aggregate shall have a zero tolerance of ±0.5 percent of the designated total batch mass of the aggregate. For systems with individual weigh hoppers for the various sizes of aggregate, the zero tolerance shall be ±0.5 percent of the individual batch mass designated for each size of aggregate. Equipment for cumulative weighing of cement and mineral admixtures shall have a zero tolerance of ±0.5 percent of the designated total batch mass of the cement and mineral admixture. Equipment for weighing cement or mineral admixture separately shall have a zero tolerance of ±0.5 percent of their designated individual batch masses. Equipment for measuring water shall have a zero tolerance of ±0.5 percent of its designated mass or volume.

• The mass indicated for any batch of material shall not vary from the preselected scale setting by more than the following:

A. Aggregate weighed cumulatively shall be within 1.0 percent of the designated total batch mass of the aggregate. Aggregates weighed individually shall be within 1.5 percent of their respective designated batch masses; and
B. Cement shall be within 1.0 percent of its designated batch mass. When weighed individually, mineral admixture shall be within 1.0 percent of its designated batch mass. When mineral admixture and cement are permitted to be weighed cumulatively, cement shall be weighed first to within 1.0 percent of its designated batch mass, and the total for cement and mineral admixture shall be within 1.0 percent of the sum of their designated batch masses; and
C. Water shall be within 1.5 percent of its designated mass or volume.

• Each scale graduation shall be approximately 0.001 of the total capacity of the scale. The capacity of scales for weighing cement, mineral admixture, or cement plus mineral admixture and aggregates shall not exceed that of commercially available scales having single graduations indicating a mass not exceeding the maximum permissible mass variation above, except that no scale shall be required having a capacity of less than 500 kg, with 0.5-kg graduations.

90-5.03 PROPORTIONING

• Proportioning shall consist of dividing the aggregates into the specified sizes, each stored in a separate bin, and combining them with cement, mineral admixture, and water as provided in these specifications. Aggregates shall be proportioned by mass.

• At the time of batching, aggregates shall have been dried or drained sufficiently to result in a stable moisture content such that no visible separation of water from aggregate will take place during transportation from the proportioning plant to the point of mixing. In no event shall the free moisture content of the fine aggregate at the time of batching exceed 8 percent of its saturated, surface-dry mass.

- Should separate supplies of aggregate material of the same size group, but of different moisture content or specific gravity or surface characteristics affecting workability, be available at the proportioning plant, withdrawals shall be made from one supply exclusively and the materials therein completely exhausted before starting upon another.
- Bulk "Type IP (MS) Modified" cement shall be weighed in an individual hopper and shall be kept separate from the aggregates until the ingredients are released for discharge into the mixer.
- Bulk cement and mineral admixture may be weighed in separate, individual weigh hoppers or may be weighed in the same weigh hopper and shall be kept separate from the aggregates until the ingredients are released for discharge into the mixer. If the cement and mineral admixture are weighed cumulatively, the cement shall be weighed first.
- When cement and mineral admixtures are weighed in separate weigh hoppers**,** the weigh systems for the proportioning of the aggregate, the cement, and the mineral admixture shall be individual and distinct from all other weigh systems. Each weigh system shall be equipped with a hopper, a lever system, and an indicator to constitute an individual and independent material weighing device. The cement and the mineral admixture shall be discharged into the mixer simultaneously with the aggregate.
- The scales and weigh hoppers for bulk weighing cement, mineral admixture, or cement plus mineral admixture shall be separate and distinct from the aggregate weighing equipment.
- For batches with a volume of one cubic meter or more, the batching equipment shall conform to one of the following combinations:

A. Separate boxes and separate scale and indicator for weighing each size of aggregate.
B. Single box and scale indicator for all aggregates.
C. Single box or separate boxes and automatic weighing mechanism for all aggregates.

- In order to check the accuracy of batch masses, the gross mass and tare mass of batch trucks, truck mixers, truck agitators, and non-agitating hauling equipment shall be determined when ordered by the Engineer. The equipment shall be weighed at the Contractor's expense on scales designated by the Engineer.

90-5.03A Proportioning for Pavement

- Aggregates and bulk cement, mineral admixture, and cement plus mineral admixture for use in pavement shall be proportioned by mass by means of automatic proportioning devices of approved type conforming to these specifications.
- The Contractor shall install and maintain in operating condition an electronically actuated moisture meter that will indicate, on a readily visible scale, changes in the moisture content of the fine aggregate as it is batched within a sensitivity of 0.5 percent by mass of the fine aggregate.
- The batching of cement, mineral admixture, or cement plus mineral admixture and aggregate shall be interlocked so that a new batch cannot be started until all weigh hoppers are empty, the proportioning devices are within zero tolerance, and the discharge gates are closed. The interlock shall permit no part of the batch to be discharged until all aggregate hoppers and the cement and mineral admixture hoppers or the cement plus mineral admixture hopper are charged with masses that are within the tolerances specified in Section 90-5.02, "Proportioning Devices."
- When interlocks are required for cement and mineral admixture charging mechanisms and cement and mineral admixtures are weighed cumulatively, their charging mechanisms shall be interlocked to prevent the introduction of mineral admixture until the mass of cement in the cement weigh hopper is within the tolerances specified in Section 90-5.02, "Proportioning Devices."
- The discharge gate on the cement and mineral admixture hoppers or the cement plus mineral admixture hopper shall be designed to permit regulating the flow of cement, mineral admixture, or cement plus mineral admixture into the aggregate as directed by the Engineer.
- When separate weigh boxes are used for each size of aggregate, the discharge gates shall permit regulating the flow of each size of aggregate as directed by the Engineer.
- Material discharged from the several bins shall be controlled by gates or by mechanical conveyors. The means of withdrawal from the several bins, and of discharge from the weigh box, shall be interlocked so that not more than one bin can discharge at a time, and so that the weigh box cannot be tripped until the required quantity from each of the several bins has been deposited therein. Should a separate weigh box be used for each size of aggregate, all may be operated and discharged simultaneously.
- When the discharge from the several bins is controlled by gates, each gate shall be actuated automatically so that the required mass is discharged into the weigh box, after which the gate shall automatically close and lock.
- The automatic weighing system shall be designed so that all proportions required may be set on the weighing controller at the same time.

90-6 MIXING AND TRANSPORTING

90-6.01 GENERAL

• Concrete shall be mixed in mechanically operated mixers, except that when permitted by the Engineer, batches not exceeding 0.25 m^3 may be mixed by hand methods in conformance with the provisions in Section 90-6.05, "Hand-Mixing."

• Equipment having components made of aluminum or magnesium alloys that would have contact with plastic concrete during mixing, transporting, or pumping of portland cement concrete shall not be used.

• Concrete shall be homogeneous and thoroughly mixed, and there shall be no lumps or evidence of undispersed cement, mineral admixture, or cement plus mineral admixture.

• Uniformity of concrete mixtures will be determined by differences in penetration as determined by California Test 533, or slump as determined by ASTM Designation: C 143, and by variations in the proportion of coarse aggregate as determined by California Test 529.

• When the mix design specifies a penetration value, the difference in penetration, determined by comparing penetration tests on 2 samples of mixed concrete from the same batch or truck mixer load, shall not exceed 10 mm. When the mix design specifies a slump value, the difference in slump, determined by comparing slump tests on 2 samples of mixed concrete from the same batch or truck mixer load, shall not exceed the values given in the table below. Variation in the proportion of coarse aggregate will be determined by comparing the results of tests of 2 samples of mixed concrete from the same batch or truck mixer load and the difference between the 2 results shall not exceed 100 kg per cubic meter of concrete.

Average Slump	Maximum Permissible Difference
Less than 100-mm	25-mm
100-mm to 150-mm	38-mm
Greater than 150-mm to 225-mm	50-mm

• The Contractor, at the Contractor's expense, shall furnish samples of the freshly mixed concrete and provide satisfactory facilities for obtaining the samples.

90-6.02 MACHINE MIXING

• Concrete mixers may be of the revolving drum or the revolving blade type, and the mixing drum or blades shall be operated uniformly at the mixing speed recommended by the manufacturer. Mixers and agitators that have an accumulation of hard concrete or mortar shall not be used.

• The temperature of mixed concrete, immediately before placing, shall be not less than 10°C or more than 32°C. Aggregates and water shall be heated or cooled as necessary to produce concrete within these temperature limits. Neither aggregates nor mixing water shall be heated to exceed 65°C. If ice is used to cool the concrete, discharge of the mixer will not be permitted until all ice is melted.

• The batch shall be so charged into the mixer that some water will enter in advance of cementitious materials and aggregates. All water shall be in the drum by the end of the first one - fourth of the specified mixing time.

• Cementitious materials shall be batched and charged into the mixer by means that will not result either in loss of cementitious materials due to the effect of wind, in accumulation of cementitious materials on surfaces of conveyors or hoppers, or in other conditions that reduce or vary the required quantity of cementitious material in the concrete mixture.

• Paving and stationary mixers shall be operated with an automatic timing device. The timing device and discharge mechanism shall be interlocked so that during normal operation no part of the batch will be discharged until the specified mixing time has elapsed.

• The total elapsed time between the intermingling of damp aggregates and all cementitious materials and the start of mixing shall not exceed 30 minutes.

• The size of batch shall not exceed the manufacturer's guaranteed capacity.

• When producing concrete for pavement or base, suitable batch counters shall be installed and maintained in good operating condition at jobsite batching plants and stationary mixers. The batch counters shall indicate the exact number of batches proportioned and mixed.

• Concrete shall be mixed and delivered to the jobsite by means of one of the following combinations of operations:

A. Mixed completely in a stationary mixer and the mixed concrete transported to the point of delivery in truck agitators or in non-agitating hauling equipment (central-mixed concrete).
B. Mixed partially in a stationary mixer, and the mixing completed in a truck mixer (shrink-mixed concrete).
C. Mixed completely in a truck mixer (transit-mixed concrete).
D. Mixed completely in a paving mixer.

• Agitators may be truck mixers operating at agitating speed or truck agitators. Each mixer and agitator shall have attached thereto in a prominent place a metal plate or plates on which is plainly marked the various uses for which the equipment is designed, the manufacturer's guaranteed capacity of the drum or container in terms of the volume of mixed concrete and the speed of rotation of the mixing drum or blades.

• Truck mixers shall be equipped with electrically or mechanically actuated revolution counters by which the number of revolutions of the drum or blades may readily be verified.

• When shrink-mixed concrete is furnished, concrete that has been partially mixed at a central plant shall be transferred to a truck mixer and all requirements for transit-mixed concrete shall apply. No credit in the number of revolutions at mixing speed shall be allowed for partial mixing in a central plant.

90-6.03 TRANSPORTING MIXED CONCRETE

• Mixed concrete may be transported to the delivery point in truck agitators or truck mixers operating at the speed designated by the manufacturer of the equipment as agitating speed, or in non-agitating hauling equipment, provided the consistency and workability of the mixed concrete upon discharge at the delivery point is suitable for adequate placement and consolidation in place, and provided the mixed concrete after hauling to the delivery point conforms to the provisions in Section 90-6.01, "General."

• Truck agitators shall be loaded not to exceed the manufacturer's guaranteed capacity and shall maintain the mixed concrete in a thoroughly mixed and uniform mass during hauling.

• Bodies of non-agitating hauling equipment shall be constructed so that leakage of the concrete mix, or any part thereof, will not occur at any time.

• Concrete hauled in open-top vehicles shall be protected during hauling against rain or against exposure to the sun for more than 20 minutes when the ambient temperature exceeds 24°C.

• No additional mixing water shall be incorporated into the concrete during hauling or after arrival at the delivery point, unless authorized by the Engineer. If the Engineer authorizes additional water to be incorporated into the concrete, the drum shall be revolved not less than 30 revolutions at mixing speed after the water is added and before discharge is commenced.

• The rate of discharge of mixed concrete from truck mixer-agitators shall be controlled by the speed of rotation of the drum in the discharge direction with the discharge gate fully open.

• When a truck mixer or agitator is used for transporting concrete to the delivery point, discharge shall be completed within 1.5 hours or before 250 revolutions of the drum or blades, whichever occurs first, after the introduction of the cement to the aggregates. Under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 30°C or above, the time allowed may be less than 1.5 hours.

• When non-agitating hauling equipment is used for transporting concrete to the delivery point, discharge shall be completed within one hour after the addition of the cement to the aggregates. Under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 30°C or above, the time between the introduction of cement to the aggregates and discharge shall not exceed 45 minutes.

• Each load of concrete delivered at the jobsite shall be accompanied by a weighmaster certificate showing the mix identification number, non-repeating load number, date and time at which the materials were batched, the total amount of water added to the load, and for transit-mixed concrete, the reading of the revolution counter at the time the truck mixer is charged with cement. This weighmaster certificate shall also show the actual scale masses (kilograms) for the ingredients batched. Theoretical or target batch masses shall not be used as a substitute for actual scale masses.

• Weighmaster certificates shall be provided in printed form, or if approved by the Engineer, the data may be submitted in electronic media. Electronic media shall be presented in a tab-delimited format on a 90 mm diskette with a capacity of at least 1.4 megabytes. Captured data, for the ingredients represented by each batch shall be "line feed, carriage return" (LFCR) and "one line, separate record" with allowances for sufficient fields to satisfy the amount of data required by these specifications.

• The Contractor may furnish a weighmaster certificate accompanied by a separate certificate that lists the actual batch masses or measurements for a load of concrete provided that both certificates are imprinted with the same non-repeating load number that is unique to the contract and delivered to the jobsite with the load.

• Weighmaster certificates furnished by the Contractor shall conform to the provisions in Section 9-1.01, "Measurement of Quantities."

90-6.04 TIME OR AMOUNT OF MIXING

• Mixing of concrete in paving or stationary mixers shall continue for the required mixing time after all ingredients, except water and admixture, if added with the water, are in the mixing compartment of the mixer before any part of the batch is released. Transfer time in multiple drum mixers shall not be counted as part of the required mixing time.

• The required mixing time, in paving or stationary mixers, of concrete used for concrete structures, except minor structures, shall be not less than 90 seconds or more than 5 minutes, except that when directed by the Engineer in writing, the requirements of the following paragraph shall apply.

• The required mixing time, in paving or stationary mixers, except as provided in the preceding paragraph, shall be not less than 50 seconds or more than 5 minutes.

• The minimum required revolutions at the mixing speed for transit-mixed concrete shall not be less than that recommended by the mixer manufacturer, but in no case shall the number of revolutions be less than that required to consistently produce concrete conforming to the provisions for uniformity in Section 90-6.01, "General."

90-6.05 HAND-MIXING

• Hand-mixed concrete shall be made in batches of not more than 0.25 m^3 and shall be mixed on a watertight, level platform. The proper amount of coarse aggregate shall be measured in measuring boxes and spread on the platform and the fine aggregate shall be spread on this layer, the 2 layers being not more than 0.3 meters in total depth. On this mixture shall be spread the dry cement and mineral admixture and the whole mass turned no fewer than 2 times dry; then sufficient clean water shall be added, evenly distributed, and the whole mass again turned no fewer than 3 times, not including placing in the carriers or forms.

90-6.06 AMOUNT OF WATER AND PENETRATION

• The amount of water used in concrete mixes shall be regulated so that the penetration of the concrete as determined by California Test 533 or the slump of the concrete as determined by ASTM Designation: C 143 is within the "Nominal" values shown in the following table. When the penetration or slump of the concrete is found to exceed the nominal values listed, the mixture of subsequent batches shall be adjusted to reduce the penetration or slump to a value within the nominal range shown. Batches of concrete with a penetration or slump exceeding the maximum values listed shall not be used in the work. When Type F or Type G chemical admixtures are added to the mix, the penetration requirements shall not apply and the slump shall not exceed 225 mm after the chemical admixtures are added.

Type of Work	Nominal		Maximum	
	Penetration (mm)	Slump (mm)	Penetration (mm)	Slump (mm)
Concrete Pavement	0-25	—	40	—
Non-reinforced concrete facilities	0-35	—	50	—
Reinforced concrete structures				
Sections over 300-mm thick	0-35	—	65	—
Sections 300-mm thick or less	0-50	—	75	—
Concrete placed under water	—	150-200	—	225
Cast-in-place concrete piles	65-90	130-180	100	200

• The amount of free water used in concrete shall not exceed 183 kg/m^3, plus 20 kg for each required 100 kg of cementitious material in excess of 325 kg/m^3.

• The term free water is defined as the total water in the mixture minus the water absorbed by the aggregates in reaching a saturated surface-dry condition.

• Where there are adverse or difficult conditions that affect the placing of concrete, the above specified penetration and free water content limitations may be exceeded providing the Contractor is granted permission by the Engineer in writing to increase the cementitious material content per cubic meter of concrete. The increase in water and cementitious material shall be at a ratio not to exceed 30 kg of water per added 100 kg of cementitious material per cubic meter. The cost of additional cementitious material and water added under these conditions shall be at the Contractor's expense and no additional compensation will be allowed therefor.

• The equipment for supplying water to the mixer shall be constructed and arranged so that the amount of water added can be measured accurately. Any method of discharging water into the mixer for a batch shall be accurate within 1.5 percent of the quantity of water required to be added to the mix for any position of the mixer. Tanks used to measure water shall be designed so that water cannot enter while water is being discharged into the mixer and discharge into the mixer shall be made rapidly in one operation without dribbling. All equipment shall be arranged so as to permit checking the amount of water delivered by discharging into measured containers.

90-7 CURING CONCRETE

90-7.01 METHODS OF CURING

- Newly placed concrete shall be cured by the methods specified in this Section 90-7.01 and the special provisions.

90-7.01A Water Method

- The concrete shall be kept continuously wet by the application of water for a minimum curing period of 7 days after the concrete has been placed.
- When a curing medium consisting of cotton mats, rugs, carpets, or earth or sand blankets is to be used to retain the moisture, the entire surface of the concrete shall be kept damp by applying water with a nozzle that so atomizes the flow that a mist and not a spray is formed, until the surface of the concrete is covered with the curing medium. The moisture from the nozzle shall not be applied under pressure directly upon the concrete and shall not be allowed to accumulate on the concrete in a quantity sufficient to cause a flow or wash the surface. At the expiration of the curing period, the concrete surfaces shall be cleared of all curing mediums.
- When concrete bridge decks and flat slabs are to be cured without the use of a curing medium, the entire surface of the bridge deck or slab shall be kept damp by the application of water with an atomizing nozzle as specified in the preceding paragraph, until the concrete has set, after which the entire surface of the concrete shall be sprinkled continuously with water for a period of not less than 7 days.

90-7.01B Curing Compound Method

- Surfaces of the concrete that are exposed to the air shall be sprayed uniformly with a curing compound.
- Curing compounds to be used shall be as follows:

1. Pigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 2, Class B, except the resin type shall be poly-alpha-methylstyrene.
2. Pigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 2, Class B.
3. Pigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 2, Class A.
4. Non-pigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 1, Class B.
5. Non-pigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 1, Class A.
6. Non-pigmented curing compound with fugitive dye conforming to the requirements in ASTM Designation: C 309, Type 1-D, Class A.

- The infrared scan for the dried vehicle from curing compound (1) shall match the infrared scan on file at the Transportation Laboratory.
- The loss of water for each type of curing compound, when tested in conformance with the requirements in California Test 534, shall not be more than 0.15-kg/m^2 in 24 hours or more than 0.45-kg/m^2 in 72 hours.
- The curing compound to be used will be specified elsewhere in these specifications or in the special provisions.
- When the use of curing compound is required or permitted elsewhere in these specifications or in the special provisions and no specific kind is specified, any of the curing compounds listed above may be used.
- Curing compound shall be applied at a nominal rate of 3.7 m^2/L, unless otherwise specified.
- At any point, the application rate shall be within ±1.2 m^2/L of the nominal rate specified, and the average application rate shall be within ±0.5 m^2/L of the nominal rate specified when tested in conformance with the requirements in California Test 535. Runs, sags, thin areas, skips, or holidays in the applied curing compound shall be evidence that the application is not satisfactory.
- Curing compounds shall be applied using power operated spray equipment. The power operated spraying equipment shall be equipped with an operational pressure gage and a means of controlling the pressure. Hand spraying of small and irregular areas that are not reasonably accessible to mechanical spraying equipment, in the opinion of the Engineer, may be permitted.
- The curing compound shall be applied to the concrete following the surface finishing operation, immediately before the moisture sheen disappears from the surface, but before any drying shrinkage or craze cracks begin to appear. In the event of any drying or cracking of the surface, application of water with an atomizing nozzle as specified in Section 90-7.01A, "Water Method," shall be started immediately and shall be continued until application of the compound is resumed or started; however, the compound shall not be applied over any resulting freestanding water. Should the film of compound be damaged from any cause before the expiration of 7 days after the concrete is placed in the case of structures and 72 hours in the case of pavement, the damaged portion shall be repaired immediately with additional compound.

- At the time of use, compounds containing pigments shall be in a thoroughly mixed condition with the pigment uniformly dispersed throughout the vehicle. A paddle shall be used to loosen all settled pigment from the bottom of the container, and a power driven agitator shall be used to disperse the pigment uniformly throughout the vehicle.
- Agitation shall not introduce air or other foreign substance into the curing compound.
- The manufacturer shall include in the curing compound the necessary additives for control of sagging, pigment settling, leveling, de-emulsification, or other requisite qualities of a satisfactory working material. Pigmented curing compounds shall be manufactured so that the pigment does not settle badly, does not cake or thicken in the container, and does not become granular or curdled. Settlement of pigment shall be a thoroughly wetted, soft, mushy mass permitting the complete and easy vertical penetration of a paddle. Settled pigment shall be easily redispersed, with minimum resistance to the sideways manual motion of the paddle across the bottom of the container, to form a smooth uniform product of the proper consistency.
- Curing compounds shall remain sprayable at temperatures above 4°C and shall not be diluted or altered after manufacture.
- The curing compound shall be packaged in clean 210-L barrels or round 19-L containers or shall be supplied from a suitable storage tank located at the jobsite. The containers shall comply with "Title 49, Code of Federal Regulations, Hazardous Materials Regulations." The 210-L barrels shall have removable lids and airtight fasteners. The 19-L containers shall be round and have standard full open head and bail. Lids with bungholes shall not be permitted. On-site storage tanks shall be kept clean and free of contaminants. Each tank shall have a permanent system designed to completely redisperse settled material without introducing air or other foreign substances.
- Steel containers and lids shall be lined with a coating that will prevent destructive action by the compound or chemical agents in the air space above the compound. The coating shall not come off the container or lid as skins. Containers shall be filled in a manner that will prevent skinning. Plastic containers shall not react with the compound.
- Each container shall be labeled with the manufacturer's name, kind of curing compound, batch number, volume, date of manufacture, and volatile organic compound (VOC) content. The label shall also warn that the curing compound containing pigment shall be well stirred before use. Precautions concerning the handling and the application of curing compound shall be shown on the label of the curing compound containers in conformance with the Construction Safety Orders and General Industry Safety Orders of the State of California.
- Containers of curing compound shall be labeled to indicate that the contents fully comply with the rules and regulations concerning air pollution control in the State of California.
- When the curing compound is shipped in tanks or tank trucks, a shipping invoice shall accompany each load. The invoice shall contain the same information as that required herein for container labels.
- Curing compound will be sampled by the Engineer at the source of supply or at the jobsite or at both locations.
- Curing compound shall be formulated so as to maintain the specified properties for a minimum of one year. The Engineer may require additional testing before use to determine compliance with these specifications if the compound has not been used within one year or whenever the Engineer has reason to believe the compound is no longer satisfactory.
- Tests will be conducted in conformance with the latest ASTM test methods and methods in use by the Transportation Laboratory.

90-7.01C Waterproof Membrane Method

- The exposed finished surfaces of concrete shall be sprayed with water, using a nozzle that so atomizes the flow that a mist and not a spray is formed, until the concrete has set, after which the curing membrane shall be placed. The curing membrane shall remain in place for a period of not less than 72 hours.
- Sheeting material for curing concrete shall conform to the requirements in AASHTO Designation: M 171 for white reflective materials.
- The sheeting material shall be fabricated into sheets of such width as to provide a complete cover for the entire concrete surface. Joints in the sheets shall be securely cemented together in such a manner as to provide a waterproof joint. The joint seams shall have a minimum lap of 100 mm.
- The sheets shall be securely weighted down by placing a bank of earth on the edges of the sheets or by other means satisfactory to the Engineer.
- Should any portion of the sheets be broken or damaged before the expiration of 72 hours after being placed, the broken or damaged portions shall be immediately repaired with new sheets properly cemented into place.
- Sections of membrane that have lost their waterproof qualities or have been damaged to such an extent as to render them unfit for curing the concrete shall not be used.

90-7.01D Forms-In-Place Method

- Formed surfaces of concrete may be cured by retaining the forms in place. The forms shall remain in place for a minimum period of 7 days after the concrete has been placed, except that for members over 0.5-m in least dimension the forms shall remain in place for a minimum period of 5 days.

• Joints in the forms and the joints between the end of forms and concrete shall be kept moisture tight during the curing period. Cracks in the forms and cracks between the forms and the concrete shall be resealed by methods subject to the approval of the Engineer.

90-7.02 CURING PAVEMENT

• The entire exposed area of the pavement, including edges, shall be cured by the waterproof membrane method, or curing compound method using curing compound (1) or (2) as the Contractor may elect. Should the side forms be removed before the expiration of 72 hours following the start of curing, the exposed pavement edges shall also be cured. If the pavement is cured by means of the curing compound method, the sawcut and all portions of the curing compound that have been disturbed by sawing operations shall be restored by spraying with additional curing compound.

• Curing shall commence as soon as the finishing process provided in Section 40-1.10, "Final Finishing," has been completed. The method selected shall conform to the provisions in Section 90-7.01, "Methods of Curing."

• When the curing compound method is used, the compound shall be applied to the entire pavement surface by mechanical sprayers. Spraying equipment shall be of the fully atomizing type equipped with a tank agitator that provides for continual agitation of the curing compound during the time of application. The spray shall be adequately protected against wind, and the nozzles shall be so oriented or moved mechanically transversely as to result in the minimum specified rate of coverage being applied uniformly on exposed faces. Hand spraying of small and irregular areas, and areas inaccessible to mechanical spraying equipment, in the opinion of the Engineer, will be permitted. When the ambient air temperature is above 15°C, the Contractor shall fog the surface of the concrete with a fine spray of water as specified in Section 90-7.01A, "Water Method." The surface of the pavement shall be kept moist between the hours of 10:00 a.m. and 4:30 p.m. on the day the concrete is placed. However, the fogging done after the curing compound has been applied shall not begin until the compound has set sufficiently to prevent displacement. Fogging shall be discontinued if ordered in writing by the Engineer.

90-7.03 CURING STRUCTURES

• Newly placed concrete for cast-in-place structures, other than highway bridge decks, shall be cured by the water method, the forms-in-place method, or, as permitted herein, by the curing compound method, in conformance with the provisions in Section 90-7.01, "Methods of Curing."

• The curing compound method using a pigmented curing compound may be used on concrete surfaces of construction joints, surfaces that are to be buried underground, and surfaces where only Ordinary Surface Finish is to be applied and on which a uniform color is not required and that will not be visible from a public traveled way. If the Contractor elects to use the curing compound method on the bottom slab of box girder spans, the curing compound shall be curing compound (1).

• The top surface of highway bridge decks shall be cured by both the curing compound method and the water method. The curing compound shall be curing compound (1).

• Concrete surfaces of minor structures, as defined in Section 51-1.02, "Minor Structures," shall be cured by the water method, the forms-in-place method or the curing compound method.

• When deemed necessary by the Engineer during periods of hot weather, water shall be applied to concrete surfaces being cured by the curing compound method or by the forms-in-place method, until the Engineer determines that a cooling effect is no longer required. Application of water for this purpose will be paid for as extra work as provided in Section 4-1.03D, "Extra Work."

90-7.04 CURING PRECAST CONCRETE MEMBERS

• Precast concrete members shall be cured in conformance with any of the methods specified in Section 90-7.01, "Methods of Curing." Curing shall be provided for the minimum time specified for each method or until the concrete reaches its design strength, whichever is less. Steam curing may also be used for precast members and shall conform to the following provisions:

A. After placement of the concrete, members shall be held for a minimum 4-hour presteaming period. If the ambient air temperature is below 10°C, steam shall be applied during the presteaming period to hold the air surrounding the member at a temperature between 10°C and 32°C.
B. To prevent moisture loss on exposed surfaces during the presteaming period, members shall be covered as soon as possible after casting or the exposed surfaces shall be kept wet by fog spray or wet blankets.
C. Enclosures for steam curing shall allow free circulation of steam about the member and shall be constructed to contain the live steam with a minimum moisture loss. The use of tarpaulins or similar flexible covers will be permitted, provided they are kept in good repair and secured in such a manner as to prevent the loss of steam and moisture.

D. Steam at the jets shall be at low pressure and in a saturated condition. Steam jets shall not impinge directly on the concrete, test cylinders, or forms. During application of the steam, the temperature rise within the enclosure shall not exceed 22°C per hour. The curing temperature throughout the enclosure shall not exceed 65°C and shall be maintained at a constant level for a sufficient time necessary to develop the required transfer strength. Control cylinders shall be covered to prevent moisture loss and shall be placed in a location where temperature is representative of the average temperature of the enclosure.
E. Temperature recording devices that will provide an accurate, continuous, permanent record of the curing temperature shall be provided. A minimum of one temperature recording device per 60 m of continuous bed length will be required for checking temperature.
F. Members in pretension beds shall be detensioned immediately after the termination of steam curing while the concrete and forms are still warm, or the temperature under the enclosure shall be maintained above 15°C until the stress is transferred to the concrete.
G. Curing of precast concrete will be considered completed after termination of the steam curing cycle.

90-7.05 CURING PRECAST PRESTRESSED CONCRETE PILES

• Newly placed concrete for precast prestressed concrete piles shall be cured in conformance with the provisions in Section 90-7.04, "Curing Precast Concrete Members," except that piles with a class designation ending in C (corrosion resistant) shall be cured as follows:

A. Piles shall be either steam cured or water cured. If water curing is used, the piles shall be kept continuously wet by the application of water in conformance with the provisions in Section 90-7.01A, "Water Method."
B. If steam curing is used, the steam curing provisions in Section 90-7.04, "Curing Precast Concrete Members," shall apply except that the piles shall be kept continuously wet for their entire length for a period of not less than 3 days, including the holding and steam curing periods.

90-7.06 CURING SLOPE PROTECTION

• Concrete slope protection shall be cured in conformance with any of the methods specified in Section 90-7.01, "Methods of Curing."

• Concreted-rock slope protection shall be cured in conformance with any of the methods specified in Section 90-7.01, "Methods of Curing," or with a blanket of earth kept wet for 72 hours, or by sprinkling with a fine spray of water every 2 hours during the daytime for a period of 3 days.

90-7.07 CURING MISCELLANEOUS CONCRETE WORK

• Exposed surfaces of curbs shall be cured by pigmented curing compounds as specified in Section 90-7.01B, "Curing Compound Method."

• Concrete sidewalks, gutter depressions, island paving, curb ramps, driveways, and other miscellaneous concrete areas shall be cured in conformance with any of the methods specified in Section 90-7.01, "Methods of Curing."

• Shotcrete shall be cured for at least 72 hours by spraying with water, or by a moist earth blanket, or by any of the methods provided in Section 90-7.01, "Methods of Curing."

• Mortar and grout shall be cured by keeping the surface damp for 3 days.

• After placing, the exposed surfaces of sign structure foundations, including pedestal portions, if constructed, shall be cured for at least 72 hours by spraying with water, or by a moist earth blanket, or by any of the methods provided in Section 90-7.01, "Methods of Curing."

90-8 PROTECTING CONCRETE

90-8.01 GENERAL

• In addition to the provisions in Section 7-1.16, "Contractor's Responsibility for the Work and Materials," the Contractor shall protect concrete as provided in this Section 90-8.

• Concrete shall not be placed on frozen or ice-coated ground or subgrade nor on ice-coated forms, reinforcing steel, structural steel, conduits, precast members, or construction joints.

• Under rainy conditions, placing of concrete shall be stopped before the quantity of surface water is sufficient to damage surface mortar or cause a flow or wash of the concrete surface, unless the Contractor provides adequate protection against damage.

• Concrete that has been frozen or damaged by other causes, as determined by the Engineer, shall be removed and replaced by the Contractor at the Contractor's expense.

90-8.02 PROTECTING CONCRETE STRUCTURES

• Structure concrete and shotcrete used as structure concrete shall be maintained at a temperature of not less than 7°C for 72 hours after placing and at not less than 4°C for an additional 4 days. When required by the Engineer, the Contractor shall submit a written outline of the proposed methods for protecting the concrete.

90-8.03 PROTECTING CONCRETE PAVEMENT

• Pavement concrete shall be maintained at a temperature of not less than 4°C for 72 hours. When required by the Engineer, the Contractor shall submit a written outline of the proposed methods for protecting the concrete.

• Except as provided in Section 7-1.08, "Public Convenience," the Contractor shall protect concrete pavement against construction and other activities that abrade, scar, discolor, reduce texture depth, lower coefficient of friction, or otherwise damage the surface. Stockpiling, drifting, or excessive spillage of soil, gravel, petroleum products, and concrete or asphalt mixes on the surface of concrete pavement is prohibited unless otherwise specified in these specifications, the special provisions or permitted by the Engineer.

• When ordered by the Engineer or shown on the plans or specified in the special provisions, pavement crossings shall be constructed for the convenience of public traffic. The material and work necessary for the construction of the crossings, and their subsequent removal and disposal, will be paid for at the contract unit prices for the items of work involved and if there are no contract items for the work involved, payment for pavement crossings will be made by extra work as provided in Section 4-1.03D, "Extra Work.". Where public traffic will be required to cross over the new pavement, Type III portland cement may be used in concrete, if permitted in writing by the Engineer. The pavement may be opened to traffic as soon as the concrete has developed a modulus of rupture of 3.8 MPa. The modulus of rupture will be determined by California Test 523.

• No traffic or Contractor's equipment, except as hereinafter provided, will be permitted on the pavement before a period of 10 days has elapsed after the concrete has been placed, nor before the concrete has developed a modulus of rupture of at least 3.8 MPa. Concrete that fails to attain a modulus of rupture of 3.8 MPa within 10 days shall not be opened to traffic until directed by the Engineer.

• Equipment for sawing weakened plane joints will be permitted on the pavement as specified in Section 40-1.08B, "Weakened Plane Joints."

• When requested in writing by the Contractor, the tracks on one side of paving equipment will be permitted on the pavement after a modulus of rupture of 2.4 MPa has been attained, provided that:

A. Unit pressure exerted on the pavement by the paver shall not exceed 135 kPa;
B. Tracks with cleats, grousers, or similar protuberances shall be modified or shall travel on planks or equivalent protective material, so that the pavement is not damaged; and
C. No part of the track shall be closer than 0.3-m from the edge of pavement.

• In case of visible cracking of, or other damage to the pavement, operation of the paving equipment on the pavement shall be immediately discontinued.

• Damage to the pavement resulting from early use of pavement by the Contractor's equipment as provided above shall be repaired by the Contractor at the Contractor's expense.

• The State will furnish the molds and machines for testing the concrete for modulus of rupture, and the Contractor, at the Contractor's expense, shall furnish the material and whatever labor the Engineer may require.

90-9 COMPRESSIVE STRENGTH

90-9.01 GENERAL

• Concrete compressive strength requirements consist of a minimum strength that shall be attained before various loads or stresses are applied to the concrete and, for concrete designated by strength, a minimum strength at the age of 28 days or at the age otherwise allowed in Section 90-1.01, "Description." The various strengths required are specified in these specifications or the special provisions or are shown on the plans.

• The compressive strength of concrete will be determined from test cylinders that have been fabricated from concrete sampled in conformance with the requirements of California Test 539. Test cylinders will be molded and initially field cured in conformance with California Test 540. Test cylinders will be cured and tested after receipt at the testing laboratory in conformance with the requirements of California Test 521. A strength test shall consist of the average strength of 2 cylinders fabricated from material taken from a single load of concrete, except that, if any cylinder should show evidence of improper sampling, molding, or testing, that cylinder shall be discarded and the strength test shall consist of the strength of the remaining cylinder.

- When concrete compressive strength is specified as a prerequisite to applying loads or stresses to a concrete structure or member, test cylinders for other than steam cured concrete will be cured in conformance with Method 1 of California Test 540. The compressive strength of concrete determined for these purposes will be evaluated on the basis of individual tests.
- When concrete is designated by 28-day compressive strength rather than by cementitious material content, the concrete strength to be used as a basis for acceptance of other than steam cured concrete will be determined from cylinders cured in conformance with Method 1 of California Test 540. If the result of a single compressive strength test at the maximum age specified or allowed is below the specified strength but is 95 percent or more of the specified strength, the Contractor shall, at the Contractor's expense, make corrective changes, subject to approval of the Engineer, in the mix proportions or in the concrete fabrication procedures, before placing additional concrete, and shall pay to the State $14 for each in-place cubic meter of concrete represented by the deficient test. If the result of a single compressive strength test at the maximum age specified or allowed is below 95 percent of the specified strength, but is 85 percent or more of the specified strength, the Contractor shall make the corrective changes specified above, and shall pay to the State $20 for each in place cubic meter of concrete represented by the deficient test. In addition, such corrective changes shall be made when the compressive strength of concrete tested at 7 days indicates, in the judgment of the Engineer, that the concrete will not attain the required compressive strength at the maximum age specified or allowed. Concrete represented by a single test that indicates a compressive strength of less than 85 percent of the specified 28-day compressive strength will be rejected in conformance with the provisions in Section 6-1.04, "Defective Materials."
- If the test result indicates that the compressive strength at the maximum curing age specified or allowed is below the specified strength, but is 85 percent or more of the specified strength, payments to the State as required above shall be made, unless the Contractor, at the Contractor's expense, obtains and submits evidence acceptable to the Engineer that the strength of the concrete placed in the work meets or exceeds the specified 28-day compressive strength. If the test result indicates a compressive strength at the maximum curing age specified or allowed below 85 percent, the concrete represented by that test will be rejected, unless the Contractor, at the Contractor's expense, obtains and submits evidence acceptable to the Engineer that the strength and quality of the concrete placed in the work are acceptable. If the evidence consists of tests made on cores taken from the work, the cores shall be obtained and tested in conformance with the requirements in ASTM Designation: C 42.
- No single compressive strength test shall represent more than 250 m^3.
- When a precast concrete member is steam cured, the compressive strength of the concrete will be determined from test cylinders that have been handled and stored in conformance with Method 3 of California Test 540. The compressive strength of steam cured concrete will be evaluated on the basis of individual tests representing specific portions of production. When the concrete is designated by 28-day compressive strength rather than by cementitious material content, the concrete shall be considered to be acceptable whenever its compressive strength reaches the specified 28-day compressive strength provided that strength is reached in not more than the maximum number of days specified or allowed after the member is cast.
- When concrete is specified by compressive strength, prequalification of materials, mix proportions, mixing equipment, and procedures proposed for use will be required prior to placement of the concrete. Prequalification shall be accomplished by the submission of acceptable certified test data or trial batch reports by the Contractor. Prequalification data shall be based on the use of materials, mix proportions, mixing equipment, procedures, and size of batch proposed for use in the work.
- Certified test data, in order to be acceptable, shall indicate that not less than 90 percent of at least 20 consecutive tests exceed the specified strength at the maximum number of cure days specified or allowed, and none of those tests are less than 95 percent of specified strength. Strength tests included in the data shall be the most recent tests made on concrete of the proposed mix design and all shall have been made within one year of the proposed use of the concrete.
- Trial batch test reports, in order to be acceptable, shall indicate that the average compressive strength of 5 consecutive concrete cylinders, taken from a single batch, at not more than 28 days (or the maximum age allowed) after molding shall be at least 4 MPa greater than the specified 28-day compressive strength, and no individual cylinder shall have a strength less than the specified strength at the maximum age specified or allowed. Data contained in the report shall be from trial batches that were produced within one year of the proposed use of specified strength concrete in the project. Whenever air-entrainment is required, the air content of trial batches shall be equal to or greater than the air content specified for the concrete without reduction due to tolerances.
- Tests shall be performed in conformance with either the appropriate California Test methods or the comparable ASTM test methods. Equipment employed in testing shall be in good condition and shall be properly calibrated. If the tests are performed during the life of the contract, the Engineer shall be notified sufficiently in advance of performing the tests in order to witness the test procedures.
- The certified test data and trial batch test reports shall include the following information:

A. Date of mixing.
B. Mixing equipment and procedures used.
C. The size of batch in cubic meters and the mass, type, and source of all ingredients used.
D. Penetration of the concrete.
E. The air content of the concrete if an air-entraining admixture is used.
F. The age at time of testing and strength of all concrete cylinders tested.

- Certified test data and trial batch test reports shall be signed by an official of the firm that performed the tests.
- When approved by the Engineer, concrete from trial batches may be used in the work at locations where concrete of a lower quality is required and the concrete will be paid for as the type or class of concrete required at that location.
- After materials, mix proportions, mixing equipment, and procedures for concrete have been prequalified for use, additional prequalification by testing of trial batches will be required prior to making changes that, in the judgment of the Engineer, could result in a strength of concrete below that specified.
- The Contractor's attention is directed to the time required to test trial batches and the Contractor shall be responsible for production of trial batches at a sufficiently early date so that the progress of the work is not delayed.
- When precast concrete members are manufactured at the plant of an established manufacturer of precast concrete members, the mix proportions of the concrete shall be determined by the Contractor, and a trial batch and prequalification of the materials, mix proportions, mixing equipment, and procedures will not be required.

90-10 MINOR CONCRETE

90-10.01 GENERAL

- Concrete for minor structures, slope paving, curbs, sidewalks and other concrete work, when designated as minor concrete on the plans, in the specifications, or in the contract item, shall conform to the provisions specified herein.
- The Engineer, at the Engineer's discretion, will inspect and test the facilities, materials and methods for producing the concrete to ensure that minor concrete of the quality suitable for use in the work is obtained.

90-10.02 MATERIALS

- Minor concrete shall conform to the following requirements:

90-10.02A Cementitious Material

- Cementitious material shall conform to the provisions in Section 90-1.01, "Description."

90-10.02B Aggregate

- Aggregate shall be clean and free from deleterious coatings, clay balls, roots, and other extraneous materials.
- The Contractor shall submit to the Engineer for approval, a grading of the combined aggregate proposed for use in the minor concrete. After acceptance of the grading, aggregate furnished for minor concrete shall conform to that grading, unless a change is authorized in writing by the Engineer.
- The Engineer may require the Contractor to furnish periodic test reports of the aggregate grading furnished. The maximum size of aggregate used shall be at the option of the Contractor, but in no case shall the maximum size be larger than 37.5 mm or smaller than 19 mm.
- The Engineer may waive, in writing, the gradation requirements in this Section 90-10.02B, if, in the Engineer's opinion, the furnishing of the gradation is not necessary for the type or amount of concrete work to be constructed.

90-10.02C Water

- Water used for washing, mixing, and curing shall be free from oil, salts, and other impurities that would discolor or etch the surface or have an adverse affect on the quality of the concrete.

90-10.02D Admixtures

- The use of admixtures shall conform to the provisions in Section 90-4, "Admixtures."

90-10.03 PRODUCTION

- Cementitious material, water, aggregate, and admixtures shall be stored, proportioned, mixed, transported, and discharged in conformance with recognized standards of good practice that will result in concrete that is thoroughly and uniformly mixed, that is suitable for the use intended, and that conforms to requirements specified herein. Recognized

standards of good practice are outlined in various industry publications such as are issued by American Concrete Institute, AASHTO, or the Department.

- The cementitious material content of minor concrete shall conform to the provisions in Section 90-1.01, "Description."
- The amount of water used shall result in a consistency of concrete conforming to the provisions in Section 90-6.06, "Amount of Water and Penetration." Additional mixing water shall not be incorporated into the concrete during hauling or after arrival at the delivery point, unless authorized by the Engineer.
- Discharge of ready-mixed concrete from the transporting vehicle shall be made while the concrete is still plastic and before stiffening occurs. An elapsed time of 1.5 hours (one hour in non-agitating hauling equipment), or more than 250 revolutions of the drum or blades, after the introduction of the cementitious material to the aggregates, or a temperature of concrete of more than 32°C will be considered conditions contributing to the quick stiffening of concrete. The Contractor shall take whatever action is necessary to eliminate quick stiffening, except that the addition of water will not be permitted.
- The required mixing time in stationary mixers shall be not less than 50 seconds or more than 5 minutes.
- The minimum required revolutions at mixing speed for transit-mixed concrete shall be not less than that recommended by the mixer manufacturer, and shall be increased, if necessary, to produce thoroughly and uniformly mixed concrete.
- Each load of ready-mixed concrete shall be accompanied by a weighmaster certificate that shall be delivered to the Engineer at the discharge location of the concrete, unless otherwise directed by the Engineer. The weighmaster certificate shall be clearly marked with the date and time of day when the load left the batching plant and, if hauled in truck mixers or agitators, the time the mixing cycle started.
- A Certificate of Compliance conforming to the provisions in Section 6–1.07, "Certificates of Compliance," shall be furnished to the Engineer, prior to placing minor concrete from a source not previously used on the contract, stating that minor concrete to be furnished meets contract requirements, including minimum cementitious material content specified.

90-10.04 CURING MINOR CONCRETE

- Curing minor concrete shall conform to the provisions in Section 90-7, "Curing Concrete."

90-10.05 PROTECTING MINOR CONCRETE

- Protecting minor concrete shall conform to the provisions in Section 90-8, "Protecting Concrete," except the concrete shall be maintained at a temperature of not less than 4°C for 72 hours after placing.

90-10.06 MEASUREMENT AND PAYMENT

- Minor concrete will be measured and paid for in conformance with the provisions specified in the various sections of these specifications covering concrete construction when minor concrete is specified in the specifications, shown on the plans, or indicated by contract item in the Engineer's Estimate.

90-11 MEASUREMENT AND PAYMENT

90-11.01 MEASUREMENT

- Portland cement concrete will be measured in conformance with the provisions specified in the various sections of these specifications covering construction requiring concrete.
- When it is provided that concrete will be measured at the mixer, the volume in cubic meters shall be computed as the total mass of the batch in kilograms divided by the density of the concrete in kilograms per cubic meter. The total mass of the batch shall be calculated as the sum of all materials, including water, entering the batch. The density of the concrete will be determined in conformance with the requirements in California Test 518.

90-11.02 PAYMENT

- Portland cement concrete will be paid for in conformance with the provisions specified in the various sections of these specifications covering construction requiring concrete.
- Full compensation for furnishing and incorporating admixtures required by these specifications or the special provisions will be considered as included in the contract prices paid for the concrete involved and no additional compensation will be allowed therefor.
- Should the Engineer order the Contractor to incorporate any admixtures in the concrete when their use is not required by these specifications or the special provisions, furnishing the admixtures and adding them to the concrete will be paid for as extra work as provided in Section 4-1.03D, "Extra Work."

• Should the Contractor use admixtures in conformance with the provisions in Section 90-4.05, "Optional Use of Chemical Admixtures," or Section 90-4.07, "Optional Use of Air-entraining Admixtures," or should the Contractor request and obtain permission to use other admixtures for the Contractor's benefit, the Contractor shall furnish those admixtures and incorporate them into the concrete at the Contractor's expense and no additional compensation will be allowed therefor.

END OF AMENDMENTS

SECTION 2. PROPOSAL REQUIREMENTS AND CONDITIONS

2-1.01 GENERAL

The bidder's attention is directed to the provisions in Section 2, "Proposal Requirements and Conditions," of the Standard Specifications and these special provisions for the requirements and conditions which the bidder must observe in the preparation of the proposal form and the submission of the bid.

In addition to the subcontractors required to be listed in conformance with Section 2-1.054, "Required Listing of Proposed Subcontractors," of the Standard Specifications, each proposal shall have listed therein the name and address of each DVBE subcontractor to be used for credit in meeting the goal, and to whom the bidder proposes to directly subcontract portions of the work. The list of subcontractors shall also set forth the portion of work that will be performed by each subcontractor listed. A sheet for listing the subcontractors is included in the Proposal.

The Bidder's Bond form mentioned in the last paragraph in Section 2-1.07, "Proposal Guaranty," of the Standard Specifications will be found following the signature page of the Proposal.

In conformance with Public Contract Code Section 7106, a Noncollusion Affidavit is included in the Proposal. Signing the Proposal shall also constitute signature of the Noncollusion Affidavit.

Submit request for substitution of an "or equal" item, and the data substantiating the request to the Department of Transportation, P.O. Box 911, Marysville, CA 95901, Attn: NRCO/Contract Administration Engineer, so that the request is received by the Department by close of business on the fourth day, not including Saturdays, Sundays and legal holidays, following bid opening.

2-1.02 DISABLED VETERAN BUSINESS ENTERPRISE (DVBE)

Section 10115 of the Public Contract Code requires the Department to implement provisions to establish a goal for Disabled Veteran Business Enterprise (DVBE) in contracts.

It is the policy of the Department that Disabled Veteran Business Enterprise (DVBE) shall have the maximum opportunity to participate in the performance of contracts financed solely with state funds. The Contractor shall ensure that DVBEs have the maximum opportunity to participate in the performance of this contract and shall take all necessary and reasonable steps for this assurance. The Contractor shall not discriminate on the basis of race, color, national origin, or sex in the award and performance of subcontracts. Failure to carry out the requirements of this paragraph shall constitute a breach of contract and may result in termination of this contract or other remedy the Department may deem appropriate.

Bidder's attention is directed to the following:

A. "Disabled Veteran Business Enterprise" (DVBE) means a business concern certified as a DVBE by the Office of Small Business Certification and Resources, Department of General Services.
B. A DVBE may participate as a prime contractor, subcontractor, joint venture partner with a prime or subcontractor, or vendor of material or supplies.
C. Credit for DVBE prime contractors will be 100 percent.
D. A DVBE joint venture partner must be responsible for specific contract items of work, or portions thereof. Responsibility means actually performing, managing and supervising the work with its own forces. The DVBE joint venture partner must share in the ownership, control, management responsibilities, risks and profits of the joint venture. The DVBE joint venturer must submit the joint venture agreement with the Caltrans Bidder DVBE Information form required in Section 2-1.04, "Submission of DVBE Information," elsewhere in these special provisions.
E. A DVBE must perform a commercially useful function, i.e., must be responsible for the execution of a distinct element of the work and must carry out its responsibility by actually performing, managing and supervising the work.
F. Credit for DVBE vendors of materials or supplies is limited to 60 percent of the amount to be paid to the vendor for the material unless the vendor manufactures or substantially alters the goods.
G. Credit for trucking by DVBEs will be as follows:

1. One hundred percent of the amount to be paid when a DVBE trucker will perform the trucking with his/her own trucks, tractors and employees.
2. Twenty percent of the amount to be paid to DVBE trucking brokers who do not have a "certified roster."
3. One hundred percent of the amount to be paid to DVBE trucking brokers who have signed agreements that all trucking will be performed by DVBE truckers if credit is toward the DVBE goal, a "certified roster" showing that all trucks are owned by DVBEs, and a signed statement on the "certified roster" that indicates that 100 percent of revenue paid by the broker will be paid to the DVBEs listed on the "certified roster."
4. Twenty percent of the amount to be paid to trucking brokers who are not a DVBE but who have signed agreements with DVBE truckers assuring that at least 20 percent of the trucking will be performed by DVBE truckers if credit is toward the DVBE goal, a "certified roster" showing that at least 20 percent of the number of trucks are owned by DVBE truckers, and a signed statement on the "certified roster" that indicates that at least 20 percent of the revenue paid by the broker will be paid to the DVBEs listed on the "certified roster."

The "certified roster" referred to herein shall conform to the requirements in Section 2-1.04, "Submission Of DVBE Information," elsewhere in these special provisions.

H. DVBEs and DVBE joint venture partners must be certified DVBEs as determined by the Department of General Services, Office of Small Business Certification and Resources, 1531 "I" Street, Second Floor, Sacramento, CA 95814, on the date bids for the project are opened before credit may be allowed toward the DVBE goal. It is the Contractor's responsibility to verify that DVBEs are certified.

I. Noncompliance by the Contractor with these requirements constitutes a breach of this contract and may result in termination of the contract or other appropriate remedy for a breach of this contract.

2-1.03 DVBE GOAL FOR THIS PROJECT

The Department has established the following goal for Disabled Veteran Business Enterprise (DVBE) participation for this project:

Disabled Veteran Business Enterprise (DVBE): 3 percent.

It is the bidder's responsibility to make a sufficient portion of the work available to subcontractors and suppliers and to select those portions of the work or material needs consistent with the available DVBE subcontractors and suppliers, so as to assure meeting the goal for DVBE participation.

The Office of Small Business Certification and Resources, Department of General Services, may be contacted at (916) 322-5060 or visit their internet web site at http://www.osmb.dgs.ca.gov/ for program information and certification status. The Department's Business Enterprise Program may also be contacted at (916) 227-9599 or the internet web site at http://www.dot.ca.gov/hq/bep/.

2-1.04 SUBMISSION OF DVBE INFORMATION

The required DVBE information shall be submitted on the "CALTRANS BIDDER - DVBE INFORMATION" form included in the Proposal. If this information is not submitted with the bid, the DVBE information forms shall be removed from the documents prior to submitting the bid.

It is the bidder's responsibility to make enough work available to DVBEs and to select those portions of the work or material needs consistent with the available DVBEs to meet the goal for DVBE participation or to provide information to establish that, prior to bidding, the bidder made adequate good faith efforts to do so.

If the DVBE information is not submitted with the bid, the apparent successful bidder (low bidder), the second low bidder and the third low bidder shall submit the DVBE information to the Department of Transportation, 1120 N Street, Room 0200, MS #26, Sacramento, California 95814 so the information is received by the Department no later than 4:00 p.m. on the fourth day, not including Saturdays, Sundays and legal holidays, following bid opening. DVBE information sent by U.S. Postal Service certified mail with return receipt and certificate of mailing and mailed on or before the third day, not including Saturdays, Sundays and legal holidays, following bid opening will be accepted even if it is received after the fourth day following bid opening. Failure to submit the required DVBE information by the time specified will be grounds for finding the bid or proposal nonresponsive. Other bidders need not submit DVBE information unless requested to do so by the Department.

The bidder's DVBE information shall establish that good faith efforts to meet the DVBE goal have been made. To establish good faith efforts, the bidder shall demonstrate that the goal will be met or that, prior to bidding, adequate good faith efforts to meet the goal were made.

Bidders are cautioned that even though their submittal indicates they will meet the stated DVBE goal, their submittal should also include their adequate good faith efforts information along with their DVBE goal information to protect their eligibility for award of the contract in the event the Department, in its review, finds that the goal has not been met.

The bidder's DVBE information shall include the names of DVBE firms that will participate, with a complete description of work or supplies to be provided by each, the dollar value of each DVBE transaction, and a written confirmation from the DVBE that it is participating in the contract. A copy of the DVBE's quote will serve as written confirmation that the DVBE is participating in the contract. When 100 percent of a contract item of work is not to be performed or furnished by a DVBE, a description of the exact portion of that work to be performed or furnished by that DVBE shall be included in the DVBE information, including the planned location of that work. The work that a DVBE prime contractor has committed to performing with its own forces as well as the work that it has committed to be performed by DVBE subcontractors, suppliers and trucking companies will count toward the goal.

If credit for trucking by a DVBE trucking broker is shown on the bidder's information as 100 percent of the revenue to be paid by the broker is to be paid to DVBE truckers, a "certified roster" of the broker's trucks to be used must be included. The "certified roster" must indicate that all the trucks are owned by certified DVBEs and must show the DVBE truck numbers, owner's name, Public Utilities Commission Cal-T numbers, and the DVBE certification numbers. The roster must indicate that all revenue paid by the broker will be paid to DVBEs listed on the "certified roster".

If credit for trucking by a trucking broker who is not a DVBE is shown in the bidder's information, a "certified roster" of the broker's trucks to be used must be included. The "certified roster" must indicate that at least 20 percent of the broker's trucks are owned by certified DVBEs and must show the DVBE truck numbers, owner's name, Public Utilities Commission Cal-T numbers, and the DVBE certification number. The roster must indicate that at least 20 percent of the revenue paid by the broker will be paid to DVBEs listed on the "certified roster".

A bidder shall be deemed to have made good faith efforts upon submittal, within time limits specified by the Department, of documentary evidence that all of the following actions were taken:

A. Contact was made with the Office of Small Business Certification and Resources (OSBCR), Department of General Services or their web site at http://www.osmb.dgs.ca.gov/ to identify Disabled Veteran Business Enterprises.
B. Advertising was published in trade media and media focusing on Disabled Veteran Business Enterprises, unless time limits imposed by the Department do not permit that advertising.
C. Invitations to bid were submitted to potential Disabled Veteran Business Enterprise contractors.
D. Available Disabled Veteran Business Enterprises were considered.

2-1.05 SMALL BUSINESS PREFERENCE

Attention is directed to "Award and Execution of Contract" of these special provisions.

Attention is also directed to the Small Business Procurement and Contract Act, Government Code Section 14835, et seq and Title 2, California Code of Regulations, Section 1896, et seq.

Bidders who wish to be classified as a Small Business under the provisions of those laws and regulations, shall be certified as Small Business by the Department of General Services, Office of Small Business Certification and Resources, 1531 "I" Street, Second Floor, Sacramento, CA 95814.

To request Small Business Preference, bidders shall fill out and sign the Request for Small Business Preference form in the Proposal and shall attach a copy of their Office of Small Business Certification and Resources (OSBCR) small business certification letter to the form. The bidder's signature on the Request for Small Business Preference certifies, under penalty of perjury, that the bidder is certified as Small Business at the time of bid opening and further certifies, under penalty of perjury, that under the following conditions, at least 50 percent of the subcontractors to be utilized on the project are either certified Small Business or have applied for Small Business certification by bid opening date and are subsequently granted Small Business certification.

The conditions requiring the aforementioned 50 percent level of subcontracting by Small Business subcontractors apply if:

A. The lowest responsible bid for the project exceeds $100,000; and
B. The project work to be performed requires a Class A or a Class B contractor's license; and
C. Two or more subcontractors will be used.

If the above conditions apply and Small Business Preference is granted in the award of the contract, the 50 percent Small Business subcontractor utilization level shall be maintained throughout the life of the contract.

2-1.06 CALIFORNIA COMPANY PREFERENCE

Attention is directed to "Award and Execution of Contract" of these special provisions.

In conformance with the requirements of Section 6107 of the Public Contract Code, a "California company" will be granted a reciprocal preference for bid comparison purposes as against a nonresident contractor from any state that gives or requires a preference to be given contractors from that state on its public entity construction contracts.

A "California company" means a sole proprietorship, partnership, joint venture, corporation, or other business entity that was a licensed California contractor on the date when bids for the public contract were opened and meets one of the following:

A. Has its principal place of business in California.
B. Has its principal place of business in a state in which there is no local contractor preference on construction contracts.
C. Has its principal place of business in a state in which there is a local contractor construction preference and the contractor has paid not less than $5000 in sales or use taxes to California for construction related activity for each of the five years immediately preceding the submission of the bid.

To carry out the "California company" reciprocal preference requirements of Section 6107 of the Public Contract Code, all bidders shall fill out and sign the California Company Preference form in the Proposal. The bidder's signature on the California Company Preference form certifies, under penalty of perjury, that the bidder is or is not a "California company" and if not, the amount of the preference applied by the state of the nonresident Contractor.

A nonresident Contractor shall disclose any and all bid preferences provided to the nonresident Contractor by the state or country in which the nonresident Contractor has its principal place of business.

Proposals without the California Company Preference form filled out and signed may be rejected.

SECTION 3. AWARD AND EXECUTION OF CONTRACT

The bidder's attention is directed to the provisions in Section 3, "Award and Execution of Contract," of the Standard Specifications and these special provisions for the requirements and conditions concerning award and execution of contract.

The award of the contract, if it be awarded, will be to the lowest responsible bidder whose proposal complies with all the requirements prescribed and who has met the goal for DVBE participation or has demonstrated, to the satisfaction of the Department, adequate good faith efforts to do so. Meeting the goal for DVBE participation or demonstrating, to the satisfaction of the Department, adequate good faith efforts to do so is a condition for being eligible for award of contract.

A "Payee Data Record" form will be included in the contract documents to be executed by the successful bidder. The purpose of the form is to facilitate the collection of taxpayer identification data. The form shall be completed and returned to the Department by the successful bidder with the executed contract and contract bonds. For the purposes of the form, payee shall be deemed to mean the successful bidder. The form is not to be completed for subcontractors or suppliers. Failure to complete and return the "Payee Data Record" form to the Department as provided herein will result in the retention of 20 percent of payments due the contractor and penalties of up to $20,000. This retention of payments for failure to complete the "Payee Data Record" form is in addition to any other retention of payments due the Contractor.

Attention is also directed to "Small Business Preference" of these special provisions. Any bidder who is certified as a Small Business by the Department of General Services, Office of Small Business Certification and Resources will be allowed a preference in the award of this contract, if it be awarded, under the following conditions:

A. The apparent low bidder is not certified as a Small Business, or has not filled out and signed the Request for Small Business Preference included with the bid documents and attached a copy of their Office of Small Business Certification and Resources (OSBCR) small business certification letter to the form; and
B. The bidder filled out and signed the Request for Small Business Preference form included with the bid documents and attached a copy of their Office of Small Business Certification and Resources (OSBCR) small business certification letter to the form.

The small business preference will be a reduction in the bid submitted by the small business contractor, for bid comparison purposes, by an amount equal to 5 percent of the amount bid by the apparent low bidder, the amount not to exceed $50,000. If this reduction results in the small business contractor becoming the low bidder, then the contract will be awarded to the small business contractor on the basis of the actual bid of the small business contractor notwithstanding the reduced bid price used for bid comparison purposes.

Attention is also directed to "California Company Preference" of these special provisions.

The amount of the California company reciprocal preference shall be equal to the amount of the preference applied by the state of the nonresident contractor with the lowest responsive bid, except where the "California company" is eligible for a California Small Business Preference, in which case the preference applied shall be the greater of the two, but not both.

If the bidder submitting the lowest responsive bid is not a "California company" and with the benefit of the reciprocal preference, a "California company's" responsive bid is equal to or less than the original lowest responsive bid, the "California company" will be awarded the contract at its submitted bid price except as provided below.

Small business bidders shall have precedence over nonsmall business bidders in that the application of the "California company" preference for which nonsmall business bidders may be eligible shall not result in the denial of the award to a small business bidder.

SECTION 4. BEGINNING OF WORK, TIME OF COMPLETION AND LIQUIDATED DAMAGES

Attention is directed to the provisions in Section 8-1.03, "Beginning of Work," in Section 8-1.06, "Time of Completion," and in Section 8-1.07, "Liquidated Damages," of the Standard Specifications and these special provisions.

The Contractor shall begin work within 15 calendar days after the contract has been approved by the Attorney General or the attorney appointed and authorized to represent the Department of Transportation.

This work shall be diligently prosecuted to completion before the expiration of **200 WORKING DAYS** beginning on the fifteenth calendar day after approval of the contract.

The Contractor shall pay to the State of California the sum of $2900 per day, for each and every calendar day's delay in finishing the work in excess of the number of working days prescribed above.

SECTION 5. GENERAL

SECTION 5-1. MISCELLANEOUS

5-1.01 PLANS AND WORKING DRAWINGS

When the specifications require working drawings to be submitted to the Division of Structure Design, the drawings shall be submitted to: Division of Structure Design, Documents Unit, Mail Station 9, 1801 30th Street, Sacramento, CA 95816, Telephone (916) 227-8252.

5-1.011 EXAMINATION OF PLANS, SPECIFICATIONS, CONTRACT, AND SITE OF WORK

Attention is directed to "Differing Site Conditions" of these special provisions regarding physical conditions at the site which may differ from those indicated in "Materials Information," log of test borings or other geotechnical information obtained by the Department's investigation of site conditions.

5-1.012 DIFFERING SITE CONDITIONS

Attention is directed to Section 5-1.116, "Differing Site Conditions," of the Standard Specifications.

During the progress of the work, if subsurface or latent conditions are encountered at the site differing materially from those indicated in the "Materials Information," log of test borings, other geotechnical data obtained by the Department's investigation of subsurface conditions, or an examination of the conditions above ground at the site, the party discovering those conditions shall promptly notify the other party in writing of the specific differing conditions before they are disturbed and before the affected work is performed.

The Contractor will be allowed 15 days from the notification of the Engineer's determination of whether or not an adjustment of the contract is warranted, in which to file a notice of potential claim in conformance with the provisions of Section 9-1.04, "Notice of Potential Claim," of the Standard Specifications and as specified herein; otherwise the decision of the Engineer shall be deemed to have been accepted by the Contractor as correct. The notice of potential claim shall set forth in what respects the Contractor's position differs from the Engineer's determination and provide any additional information obtained by the Contractor, including but not limited to additional geotechnical data. The notice of potential claim shall be accompanied by the Contractor's certification that the following were made in preparation of the bid: a review of the contract, a review of the "Materials Information," a review of the log of test borings and other records of geotechnical data to the extent they were made available to bidders prior to the opening of bids, and an examination of the conditions above ground at the site. Supplementary information, obtained by the Contractor subsequent to the filing of the notice of potential claim, shall be submitted to the Engineer in an expeditious manner.

5-1.013 LINES AND GRADES

Attention is directed to Section 5-1.07, "Lines and Grades," of the Standard Specifications.

Stakes or marks will be set by the Engineer in conformance with the requirements in Chapter 12, "Construction Surveys," of the Department's Surveys Manual.

5-1.015 LABORATORY

When a reference is made in the specifications to the "Laboratory," the reference shall mean Division of Engineering Services - Materials Engineering and Testing Services and Division of Engineering Services - Geotechnical Services of the Department of Transportation, or established laboratories of the various Districts of the Department, or other laboratories

authorized by the Department to test materials and work involved in the contract. When a reference is made in the specifications to the "Transportation Laboratory," the reference shall mean Division of Engineering Services - Materials Engineering and Testing Services and Division of Engineering Services - Geotechnical Services, located at 5900 Folsom Boulevard, Sacramento, CA 95819, Telephone (916) 227-7000.

5-1.017 CONTRACT BONDS

Attention is directed to Section 3-1.02, "Contract Bonds," of the Standard Specifications and these special provisions.

The payment bond shall be in a sum not less than one hundred percent of the total amount payable by the terms of the contract.

5-1.019 COST REDUCTION INCENTIVE

Attention is directed to Section 5-1.14, "Cost Reduction Incentive," of the Standard Specifications.

Prior to preparing a written cost reduction proposal, the Contractor shall request a meeting with the Engineer to discuss the proposal in concept. Items of discussion will also include permit issues, impact on other projects, impact on the project schedule, peer reviews, overall merit of the proposal, and review times required by the Department and other agencies.

If a cost reduction proposal submitted by the Contractor, and subsequently approved by the Engineer, provides for a reduction in contract time, 50 percent of that contract time reduction shall be credited to the State by reducing the contract working days, not including plant establishment. Attention is directed to "Beginning of Work, Time of Completion and Liquidated Damages" of these special provisions regarding the working days.

If a cost reduction proposal submitted by the Contractor, and subsequently approved by the Engineer, provides for a reduction in traffic congestion or avoids traffic congestion during construction, 60 percent of the estimated net savings in construction costs attributable to the cost reduction proposal will be paid to the Contractor. In addition to the requirements in Section 5-1.14, "Cost Reduction Incentive," of the Standard Specifications, the Contractor shall provide detailed comparisons of the traffic handling between the existing contract and the proposed change, and estimates of the traffic volumes and congestion.

5-1.02 LABOR NONDISCRIMINATION

Attention is directed to the following Notice that is required by Chapter 5 of Division 4 of Title 2, California Code of Regulations.

NOTICE OF REQUIREMENT FOR NONDISCRIMINATION PROGRAM

(GOV. CODE, SECTION 12990)

Your attention is called to the "Nondiscrimination Clause", set forth in Section 7-1.01A(4), "Labor Nondiscrimination," of the Standard Specifications, which is applicable to all nonexempt State contracts and subcontracts, and to the "Standard California Nondiscrimination Construction Contract Specifications" set forth therein. The specifications are applicable to all nonexempt State construction contracts and subcontracts of $5000 or more.

5-1.022 PAYMENT OF WITHHELD FUNDS

Payment of withheld funds shall conform to Section 9-1.065, "Payment of Withheld Funds," of the Standard Specifications and these special provisions.

Funds withheld from progress payments to ensure performance of the contract that are eligible for payment into escrow or to an escrow agent pursuant to Section 10263 of the California Public Contract Code do not include funds withheld or deducted from payment due to failure of the Contractor to fulfill a contract requirement.

5-1.03 INTEREST ON PAYMENTS

Interest shall be payable on progress payments, payments after acceptance, final payments, extra work payments, and claim payments as follows:

A. Unpaid progress payments, payment after acceptance, and final payments shall begin to accrue interest 30 days after the Engineer prepares the payment estimate.
B. Unpaid extra work bills shall begin to accrue interest 30 days after preparation of the first pay estimate following receipt of a properly submitted and undisputed extra work bill. To be properly submitted, the bill must be submitted within 7 days of the performance of the extra work and in conformance with the provisions in Section 9-1.03C, "Records," and Section 9-1.06, "Partial Payments," of the Standard Specifications. An undisputed extra work bill

not submitted within 7 days of performance of the extra work will begin to accrue interest 30 days after the preparation of the second pay estimate following submittal of the bill.

C. The rate of interest payable for unpaid progress payments, payments after acceptance, final payments, and extra work payments shall be 10 percent per annum.

D. The rate of interest payable on a claim, protest or dispute ultimately allowed under this contract shall be 6 percent per annum. Interest shall begin to accrue 61 days after the Contractor submits to the Engineer information in sufficient detail to enable the Engineer to ascertain the basis and amount of said claim, protest or dispute.

The rate of interest payable on any award in arbitration shall be 6 percent per annum if allowed under the provisions of Civil Code Section 3289.

5-1.031 FINAL PAYMENT AND CLAIMS

Attention is directed to Section 9-1.07B, "Final Payment and Claims," of the Standard Specifications.

If the Contractor files a timely written statement of claims in response to the proposed final estimate, the District that administers the contract will submit a claim position letter to the Contractor by hand delivery or deposit in the U.S. mail within 135 days of acceptance of the contract. The claim position letter will delineate the District's position on the Contractor's claims. If the Contractor disagrees with the claim position letter, the Contractor shall submit a written notification of its disagreement to be received by the District not later than 15 days after the Contractor's receipt of the claim position letter. The written notification of disagreement shall set forth the basis for the Contractor's disagreement and be submitted to the office designated in the claim position letter. The Contractor's failure to provide a timely, written notification of disagreement shall constitute the Contractor's acceptance and agreement with the determinations provided in the claim position letter and with final payment pursuant to the claim position letter.

If the Contractor files a timely notification of disagreement with the District claim position letter, the board of review designated by the District Director to review claims that remain in dispute will meet with the Contractor within 45 days after receipt by the District of the notification of disagreement. Attendance by the Contractor at the board of review meeting shall be mandatory.

If the District fails to submit a claim position letter to the Contractor within 135 days after the acceptance of the contract and the Contractor has claims that remain in dispute, the Contractor may request a meeting with the board of review designated by the District Director to review claims that remain in dispute. The Contractor's request for a meeting shall identify the claims that remain in dispute. If the Contractor files a request for a meeting, the board of review will meet with the Contractor within 45 days after the District receives the request for the meeting. Attendance by the Contractor at the District Director's board of review meeting shall be mandatory.

Failure of the Contractor to file a timely written statement of claims in response to the proposed final estimate, or to file a timely notification of disagreement with the District claim position letter, or to attend the District Director's board of review meeting shall constitute a failure to pursue diligently and exhaust the administrative procedures in the contract and shall be a bar to arbitration in conformance with the requirements in Section 10240.2 of the California Public Contract Code.

5-1.04 PUBLIC SAFETY

The Contractor shall provide for the safety of traffic and the public in conformance with the provisions in Section 7-1.09, "Public Safety," of the Standard Specifications and these special provisions.

The Contractor shall install temporary railing (Type K) between a lane open to public traffic and an excavation, obstacle or storage area when the following conditions exist:

A. Excavations**.—**The near edge of the excavation is 3.6 m or less from the edge of the lane, except:

1. Excavations covered with sheet steel or concrete covers of adequate thickness to prevent accidental entry by traffic or the public.
2. Excavations less than 0.3-m deep.
3. Trenches less than 0.3-m wide for irrigation pipe or electrical conduit, or excavations less than 0.3-m in diameter.
4. Excavations parallel to the lane for the purpose of pavement widening or reconstruction.
5. Excavations in side slopes, where the slope is steeper than 1:4 (vertical:horizontal).
6. Excavations protected by existing barrier or railing.

B. Temporarily Unprotected Permanent Obstacles**.—**The work includes the installation of a fixed obstacle together with a protective system, such as a sign structure together with protective railing, and the Contractor elects to install the obstacle prior to installing the protective system; or the Contractor, for the Contractor's convenience and with

permission of the Engineer, removes a portion of an existing protective railing at an obstacle and does not replace such railing complete in place during the same day.

C. Storage Areas.—Material or equipment is stored within 3.6 m of the lane and the storage is not otherwise prohibited by the provisions of the Standard Specifications and these special provisions.

The approach end of temporary railing (Type K), installed in conformance with the provisions in this section "Public Safety" and in Section 7-1.09, "Public Safety," of the Standard Specifications, shall be offset a minimum of 4.6 m from the edge of the traffic lane open to public traffic. The temporary railing shall be installed on a skew toward the edge of the traffic lane of not more than 0.3-m transversely to 3 m longitudinally with respect to the edge of the traffic lane. If the 4.6-m minimum offset cannot be achieved, the temporary railing shall be installed on the 10 to 1 skew to obtain the maximum available offset between the approach end of the railing and the edge of the traffic lane, and an array of temporary crash cushion modules shall be installed at the approach end of the temporary railing.

Temporary railing (Type K) shall conform to the provisions in Section 12-3.08, "Temporary Railing (Type K)," of the Standard Specifications. Temporary railing (Type K), conforming to the details shown on 1999 Standard Plan T3, may be used. Temporary railing (Type K) fabricated prior to January 1, 1993, and conforming to 1988 Standard Plan B11-30 may be used, provided the fabrication date is printed on the required Certificate of Compliance.

Temporary crash cushion modules shall conform to the provisions in "Temporary Crash Cushion Module" of these special provisions.

Except for installing, maintaining and removing traffic control devices, whenever work is performed or equipment is operated in the following work areas, the Contractor shall close the adjacent traffic lane unless otherwise provided in the Standard Specifications and these special provisions:

Approach Speed of Public Traffic (Posted Limit) (Kilometers Per Hour)	Work Areas
Over 72 (45 Miles Per Hour)	Within 1.8 m of a traffic lane but not on a traffic lane
56 to 72 (35 to 45 Miles Per Hour)	Within 0.9-m of a traffic lane but not on a traffic lane

The lane closure provisions of this section shall not apply if the work area is protected by permanent or temporary railing or barrier.

When traffic cones or delineators are used to delineate a temporary edge of a traffic lane, the line of cones or delineators shall be considered to be the edge of the traffic lane, however, the Contractor shall not reduce the width of an existing lane to less than 3 m without written approval from the Engineer.

When work is not in progress on a trench or other excavation that required closure of an adjacent lane, the traffic cones or portable delineators used for the lane closure shall be placed off of and adjacent to the edge of the traveled way. The spacing of the cones or delineators shall be not more than the spacing used for the lane closure.

Suspended loads or equipment shall not be moved nor positioned over public traffic or pedestrians.

Full compensation for conforming to the provisions in this section "Public Safety," including furnishing and installing temporary railing (Type K) and temporary crash cushion modules, shall be considered as included in the contract prices paid for the various items of work involved and no additional compensation will be allowed therefor.

5-1.05 TESTING

Testing of materials and work shall conform to the provisions in Section 6-3, "Testing," of the Standard Specifications and these special provisions.

Whenever the provisions of Section 6-3.01, "General," of the Standard Specifications refer to tests or testing, it shall mean tests to assure the quality and to determine the acceptability of the materials and work.

The Engineer will deduct the costs for testing of materials and work found to be unacceptable, as determined by the tests performed by the Department, and the costs for testing of material sources identified by the Contractor which are not used for the work, from moneys due or to become due to the Contractor. The amount deducted will be determined by the Engineer.

5-1.06 REMOVAL OF ASBESTOS AND HAZARDOUS SUBSTANCES

When the presence of asbestos or hazardous substances are not shown on the plans or indicated in the specifications and the Contractor encounters materials which the Contractor reasonably believes to be asbestos or a hazardous substance as defined in Section 25914.1 of the Health and Safety Code, and the asbestos or hazardous substance has not been rendered harmless, the Contractor may continue work in unaffected areas reasonably believed to be safe. The Contractor shall immediately cease work in the affected area and report the condition to the Engineer in writing.

In conformance with Section 25914.1 of the Health and Safety Code, removal of asbestos or hazardous substances including exploratory work to identify and determine the extent of the asbestos or hazardous substance will be performed by separate contract.

If delay of work in the area delays the current controlling operation, the delay will be considered a right of way delay and the Contractor will be compensated for the delay in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

5-1.07 YEAR 2000 COMPLIANCE

This contract is subject to Year 2000 Compliance for automated devices in the State of California.

Year 2000 compliance for automated devices in the State of California is achieved when embedded functions have or create no logical or mathematical inconsistencies when dealing with dates prior to and beyond 1999. The year 2000 is recognized and processed as a leap year. The product shall operate accurately in the manner in which the product was intended for date operation without requiring manual intervention.

The Contractor shall provide the Engineer a Certificate of Compliance from the manufacturer in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for all automated devices furnished for the project.

5-1.08 SUBCONTRACTOR AND DVBE RECORDS

The Contractor shall maintain records of all subcontracts entered into with certified DVBE subcontractors and records of materials purchased from certified DVBE suppliers. The records shall show the name and business address of each DVBE subcontractor or vendor and the total dollar amount actually paid each DVBE subcontractor or vendor.

Upon completion of the contract, a summary of these records shall be prepared on Form CEM-2402 (S) and certified correct by the Contractor or the Contractor's authorized representative, and shall be furnished to the Engineer.

5-1.086 PERFORMANCE OF DVBE SUBCONTRACTORS AND SUPPLIERS

The DVBEs listed by the Contractor in response to the provisions in Section 2-1.04, "Submission of DVBE Information," and Section 3, "Award and Execution of Contract," of these special provisions, which are determined by the Department to be certified DVBEs, shall perform the work and supply the materials for which they are listed, unless the Contractor has received prior written authorization to perform the work with other forces or to obtain the materials from other sources.

Authorization to utilize other forces or sources of materials may be requested for the following reasons:

A. The listed DVBE, after having had a reasonable opportunity to do so, fails or refuses to execute a written contract, when the written contract, based upon the general terms, conditions, plans and specifications for the project, or on the terms of the subcontractor's or supplier's written bid, is presented by the Contractor.
B. The listed DVBE becomes bankrupt or insolvent.
C. The listed DVBE fails or refuses to perform the subcontract or furnish the listed materials.
D. The Contractor stipulated that a bond was a condition of executing a subcontract and the listed DVBE subcontractor fails or refuses to meet the bond requirements of the Contractor.
E. The work performed by the listed subcontractor is substantially unsatisfactory and is not in substantial conformance with the plans and specifications or the subcontractor is substantially delaying or disrupting the progress of the work.
F. The listed DVBE subcontractor is not licensed pursuant to the Contractor's License Law.
G. It would be in the best interest of the State.

The Contractor shall not be entitled to payment for the work or material unless it is performed or supplied by the listed DVBE or by other forces (including those of the Contractor) pursuant to prior written authorization of the Engineer.

5-1.09 SUBCONTRACTING

Attention is directed to the provisions in Section 8-1.01, "Subcontracting," of the Standard Specifications, Section 2, "Proposal Requirements and Conditions," Section 2-1.04, "Submission of DVBE Information," and Section 3, "Award and Execution of Contract," of these special provisions and these special provisions.

Pursuant to the provisions in Section 1777.1 of the Labor Code, the Labor Commissioner publishes and distributes a list of contractors ineligible to perform work as a subcontractor on a public works project. This list of debarred contractors is available from the Department of Industrial Relations web site at:

http://www.dir.ca.gov/DLSE/Debar.html.

The third paragraph of Section 8-1.01 of the Standard Specifications shall not apply to this contract.

The DVBE information furnished under Section 2-1.04, "Submission of DVBE Information," of these special provisions is in addition to the subcontractor information required to be furnished in Section 8-1.01, "Subcontracting," and Section 2-1.054, "Required Listing of Proposed Subcontractors," of the Standard Specifications.

Section 10115 of the Public Contract Code requires the Department to implement provisions to establish a goal for Disabled Veteran Business Enterprise (DVBE) participation in highway contracts that are State funded. As a part of this requirement:

A. No substitution of a DVBE subcontractor shall be made at any time without the written consent of the Department, and
B. If a DVBE subcontractor is unable to perform successfully and is to be replaced, the Contractor shall make good faith efforts to replace the original DVBE subcontractor with another DVBE subcontractor.

The provisions in Section 2-1.02, "Disabled Veteran Business Enterprise (DVBE)," of these special provisions that DVBEs shall be certified on the date bids are opened does not apply to DVBE substitutions after award of the contract.

5-1.10 PROMPT PROGRESS PAYMENT TO SUBCONTRACTORS

Attention is directed to the provisions in Sections 10262 and 10262.5 of the Public Contract Code and Section 7108.5 of the Business and Professions Code concerning prompt payment to subcontractors.

5-1.103 RECORDS

The Contractor shall maintain cost accounting records for the contract pertaining to, and in such a manner as to provide a clear distinction between, the following six categories of costs of work during the life of the contract:

A. Direct costs of contract item work.
B. Direct costs of changes in character in conformance with Section 4-1.03C, "Changes in Character of Work," of the Standard Specifications.
C. Direct costs of extra work in conformance with Section 4-1.03D, "Extra Work," of the Standard Specifications.
D. Direct costs of work not required by the contract and performed for others.
E. Direct costs of work performed under a notice of potential claim in conformance with the provisions in Section 9-1.04, "Notice of Potential Claim," of the Standard Specifications.
F. Indirect costs of overhead.

Cost accounting records shall include the information specified for daily extra work reports in Section 9-1.03C, "Records," of the Standard Specifications. The requirements for furnishing the Engineer completed daily extra work reports shall only apply to work paid for on a force account basis.

The cost accounting records for the contract shall be maintained separately from other contracts, during the life of the contract, and for a period of not less than 3 years after the date of acceptance of the contract. If the Contractor intends to file claims against the Department, the Contractor shall keep the cost accounting records specified above until complete resolution of all claims has been reached.

5-1.11 PARTNERING

The State will promote the formation of a "Partnering" relationship with the Contractor in order to effectively complete the contract to the benefit of both parties. The purpose of this relationship is to maintain a cooperative communication and to mutually resolve conflicts at the lowest responsible management level.

The Contractor may request the formation of a "Partnering" relationship by submitting a request in writing to the Engineer after approval of the contract. If the Contractor's request for "Partnering" is approved by the Engineer, scheduling of a "Partnering Workshop," selecting the "Partnering" facilitator and workshop site, and other administrative details shall be as agreed to by both parties. If agreed to by the parties, additional "Partnering Workshops" will be conducted as needed throughout the life of the contract.

The costs involved in providing the "Partnering Workshop" facilitator and workshop site will be borne equally by the State and the Contractor. The division of cost will be made by determining the cost in providing the "Partnering Workshop" facilitator and workshop site in conformance with the provisions in Section 9-1.03B, "Work Performed by Special Forces or Other Special Services," of the Standard Specifications, and paying to the Contractor one-half of that cost, except no markups will be allowed.

All other costs associated with "Partnering Workshops" will be borne separately by the party incurring the costs, such as wages and travel expenses, and no additional compensation will be allowed therefor.

The establishment of a "Partnering" relationship will not change or modify the terms and conditions of the contract and will not relieve either party of the legal requirements of the contract.

5-1.12 AREAS FOR CONTRACTOR'S USE

Attention is directed to the provisions in Section 7-1.19, "Rights in Land and Improvements," of the Standard Specifications and these special provisions.

The State right of way shall be used only for purposes that are necessary to perform the required work. The Contractor shall not occupy the right of way, or allow others to occupy the right of way, for purposes which are not necessary to perform the required work.

No State-owned parcels adjacent to the right of way are available for the exclusive use of the Contractor within the contract limits. The Contractor shall secure, at the Contractor's own expense, areas required for plant sites, storage of equipment or materials, or for other purposes.

No area is available within the contract limits for the exclusive use of the Contractor. However, temporary storage of equipment and materials on State property may be arranged with the Engineer, subject to the prior demands of State maintenance forces and to other contract requirements. Use of the Contractor's work areas and other State-owned property shall be at the Contractor's own risk, and the State shall not be held liable for damage to or loss of materials or equipment located within such areas.

5-1.13 PAYMENTS

Attention is directed to Sections 9-1.06, "Partial Payments," and 9-1.07, "Payment After Acceptance," of the Standard Specifications and these special provisions.

No partial payment will be made for any materials on hand which are furnished but not incorporated in the work.

5-1.14 OBSTRUCTIONS

Attention is directed to Sections 7-1.11, "Preservation of Property," 7-1.12, "Responsibility for Damage," 7-1.16, "Contractor's Responsibility for the Work and Materials," and 8-1.10, "Utility and Non-Highway Facilities," of the Standard Specifications.

The Contractor shall notify the Engineer and the appropriate regional notification center for operators of subsurface installations at least 5 working days prior to performing any excavation or other work close to any underground pipeline, conduit, duct, wire or other structure. Regional notification centers include but are not limited to the following:

Underground Service Alert
Northern California (USA)
Telephone: 1(800)642-2444

Underground Service Alert
Southern California (USA)
Telephone: 1(800)422-4133

South Shore Utility
Coordinating Council (DIGS)
Telephone: 1(800)541-3447

Western Utilities
Underground Alert, Inc.
Telephone: 1(800)424-3447

5-1.15 PRESERVATION OF PROPERTY

Attention is directed to Sections 7-1.11, "Preservation of Property," 7-1.12, "Responsibility for Damage," 7-1.16, "Contractor's Responsibility for the Work and Materials," and 8-1.10, "Utility and Non-Highway Facilities," of the Standard Specifications.

Operations shall be conducted in such a manner that existing facilities, surfacing, installations, and utilities which are to remain in place will not be damaged. Temporary surfacing, facilities, utilities and installations shall also be protected until they are no longer required. The Contractor, at his expense shall furnish and install piling, sheet piling, cribbing, bulkheads, shores, or whatever means may be necessary to adequately support material carrying such facilities, or to support the facilities themselves and shall maintain such support until they are no longer needed.

SECTION 6. (BLANK)

SECTION 7. (BLANK)

SECTION 8. MATERIALS

SECTION 8-1. MISCELLANEOUS

8-1.01 SUBSTITUTION OF NON-METRIC MATERIALS AND PRODUCTS

Only materials and products conforming to the requirements of the specifications shall be incorporated in the work. When metric materials and products are not available, and when approved by the Engineer, and at no cost to the State, materials and products in the United States Standard Measures which are of equal quality and of the required properties and characteristics for the purpose intended, may be substituted for the equivalent metric materials and products, subject to the following provisions:

A. Materials and products shown on the plans or in the special provisions as being equivalent may be substituted for the metric materials and products specified or detailed on the plans.
B. Before other non-metric materials and products will be considered for use, the Contractor shall furnish, at the Contractor's expense, evidence satisfactory to the Engineer that the materials and products proposed for use are equal to or better than the materials and products specified or detailed on the plans. The burden of proof as to the quality and suitability of substitutions shall be upon the Contractor and the Contractor shall furnish necessary information as required by the Engineer. The Engineer will be the sole judge as to the quality and suitability of the substituted materials and products and the Engineer's decision will be final.
C. When the Contractor elects to substitute non-metric materials and products, including materials and products shown on the plans or in the special provisions as being equivalent, the list of sources of material specified in Section 6-1.01, "Source of Supply and Quality of Materials," of the Standard Specification shall include a list of substitutions to be made and contract items involved. In addition, for a change in design or details, the Contractor shall submit plans and working drawings in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. The plans and working drawings shall be submitted at least 7 days before the Contractor intends to begin the work involved.

Unless otherwise specified, the following substitutions of materials and products will be allowed:

SUBSTITUTION TABLE FOR SIZES OF HIGH STRENGTH STEEL FASTENERS
ASTM Designation: A 325M

METRIC SIZE SHOWN ON THE PLANS mm x thread pitch	SIZE TO BE SUBSTITUTED inch
M16 x 2	5/8
M20 x 2.5	3/4
M22 x 2.5	7/8
M24 x 3	1
M27 x 3	1-1/8
M30 x 3.5	1-1/4
M36 x 4	1-1/2

SUBSTITUTION TABLE FOR PLAIN WIRE REINFORCEMENT
ASTM Designation: A 82

METRIC SIZE SHOWN ON THE PLANS mm^2	SIZE TO BE SUBSTITUTED $inch^2$ x 100
MW9	W1.4
MW10	W1.6
MW13	W2.0
MW15	W2.3
MW19	W2.9
MW20	W3.1
MW22	W3.5
MW25	W3.9, except W3.5 in piles only
MW26	W4.0
MW30	W4.7
MW32	W5.0
MW35	W5.4
MW40	W6.2
MW45	W6.5
MW50	W7.8
MW55	W8.5, except W8.0 in piles only
MW60	W9.3
MW70	W10.9, except W11.0 in piles only
MW80	W12.4
MW90	W14.0
MW100	W15.5

SUBSTITUTION TABLE FOR BAR REINFORCEMENT

METRIC BAR DESIGNATION NUMBER[1] SHOWN ON THE PLANS	BAR DESIGNATION NUMBER[2] TO BE SUBSTITUTED
10	3
13	4
16	5
19	6
22	7
25	8
29	9
32	10
36	11
43	14
57	18

[1]Bar designation numbers approximate the number of millimeters of the nominal diameter of the bars.

[2]Bar numbers are based on the number of eighths of an inch included in the nominal diameter of the bars.

No adjustment will be required in spacing or total number of reinforcing bars due to a difference in minimum yield strength between metric and non-metric bars.

SUBSTITUTION TABLE FOR SIZES OF:

(1) STEEL FASTENERS FOR GENERAL APPLICATIONS (ASTM Designation: A 307 or AASHTO Designation: M 314, Grade 36 or 55), and

(2) HIGH STRENGTH STEEL FASTENERS (ASTM Designation: A 325 or A 449)

METRIC SIZE SHOWN ON THE PLANS mm	SIZE TO BE SUBSTITUTED inch
6 or 6.35	1/4
8 or 7.94	5/16
10 or 9.52	3/8
11 or 11.11	7/16
13 or 12.70	1/2
14 or 14.29	9/16
16 or 15.88	5/8
19 or 19.05	3/4
22 or 22.22	7/8
24, 25, or 25.40	1
29 or 28.58	1-1/8
32 or 31.75	1-1/4
35 or 34.93	1-3/8
38 or 38.10	1-1/2
44 or 44.45	1-3/4
51 or 50.80	2
57 or 57.15	2-1/4
64 or 63.50	2-1/2
70 or 69.85	2-3/4
76 or 76.20	3
83 or 82.55	3-1/4
89 or 88.90	3-1/2
95 or 95.25	3-3/4
102 or 101.60	4

SUBSTITUTION TABLE FOR NOMINAL THICKNESS OF SHEET METAL

UNCOATED HOT AND COLD ROLLED SHEETS		HOT-DIPPED ZINC COATED SHEETS (GALVANIZED)	
METRIC THICKNESS SHOWN ON THE PLANS mm	GAGE TO BE SUBSTITUTED inch	METRIC THICKNESS SHOWN ON THE PLANS mm	GAGE TO BE SUBSTITUTED inch
7.94	0.3125	4.270	0.1681
6.07	0.2391	3.891	0.1532
5.69	0.2242	3.510	0.1382
5.31	0.2092	3.132	0.1233
4.94	0.1943	2.753	0.1084
4.55	0.1793	2.372	0.0934
4.18	0.1644	1.994	0.0785
3.80	0.1495	1.803	0.0710
3.42	0.1345	1.613	0.0635
3.04	0.1196	1.461	0.0575
2.66	0.1046	1.311	0.0516
2.28	0.0897	1.158	0.0456
1.90	0.0747	1.006 or 1.016	0.0396
1.71	0.0673	0.930	0.0366
1.52	0.0598	0.853	0.0336
1.37	0.0538	0.777	0.0306
1.21	0.0478	0.701	0.0276
1.06	0.0418	0.627	0.0247
0.91	0.0359	0.551	0.0217
0.84	0.0329	0.513	0.0202
0.76	0.0299	0.475	0.0187
0.68	0.0269	--------	--------
0.61	0.0239	--------	--------
0.53	0.0209	--------	--------
0.45	0.0179	--------	--------
0.42	0.0164	--------	--------
0.38	0.0149	--------	--------

SUBSTITUTION TABLE FOR WIRE

METRIC THICKNESS SHOWN ON THE PLANS mm	WIRE THICKNESS TO BE SUBSTITUTED inch	GAGE NO.
6.20	0.244	3
5.72	0.225	4
5.26	0.207	5
4.88	0.192	6
4.50	0.177	7
4.11	0.162	8
3.76	0.148	9
3.43	0.135	10
3.05	0.120	11
2.69	0.106	12
2.34	0.092	13
2.03	0.080	14
1.83	0.072	15
1.57	0.062	16
1.37	0.054	17
1.22	0.048	18
1.04	0.041	19
0.89	0.035	20

SUBSTITUTION TABLE FOR PIPE PILES

METRIC SIZE SHOWN ON THE PLANS mm x mm	SIZE TO BE SUBSTITUTED inch x inch
PP 360 x 4.55	NPS 14 x 0.179
PP 360 x 6.35	NPS 14 x 0.250
PP 360 x 9.53	NPS 14 x 0.375
PP 360 x 11.12	NPS 14 x 0.438
PP 406 x 12.70	NPS 16 x 0.500
PP 460 x T	NPS 18 x T"
PP 508 x T	NPS 20 x T"
PP 559 x T	NPS 22 x T"
PP 610 x T	NPS 24 x T"
PP 660 x T	NPS 26 x T"
PP 711 x T	NPS 28 x T"
PP 762 x T	NPS 30 x T"
PP 813 x T	NPS 32 x T"
PP 864 x T	NPS 34 x T"
PP 914 x T	NPS 36 x T"
PP 965 x T	NPS 38 x T"
PP 1016 x T	NPS 40 x T"
PP 1067 x T	NPS 42 x T"
PP 1118 x T	NPS 44 x T"
PP 1219 x T	NPS 48 x T"
PP 1524 x T	NPS 60 x T"

The thickness in millimeters (T) represents an exact conversion of the thickness in inches (T").

SUBSTITUTION TABLE FOR STRUCTURAL TIMBER AND LUMBER

METRIC MINIMUM DRESSED DRY, SHOWN ON THE PLANS mm x mm	METRIC MINIMUM DRESSED GREEN, SHOWN ON THE PLANS mm x mm	NOMINAL SIZE TO BE SUBSTITUTED inch x inch
19x89	20x90	1x4
38x89	40x90	2x4
64x89	65x90	3x4
89x89	90x90	4x4
140x140	143x143	6x6
140x184	143x190	6x8
184x184	190x190	8x8
235x235	241x241	10x10
286x286	292x292	12x12

SUBSTITUTION TABLE FOR NAILS AND SPIKES

METRIC COMMON NAIL, SHOWN ON THE PLANS Length, mm Diameter, mm	METRIC BOX NAIL, SHOWN ON THE PLANS Length, mm Diameter, mm	METRIC SPIKE, SHOWN ON THE PLANS Length, mm Diameter, mm	SIZE TO BE SUBSTITUTED Penny-weight
50.80 2.87	50.80 2.51	_____	6d
63.50 3.33	63.50 2.87	_____	8d
76.20 3.76	76.20 3.25	76.20 4.88	10d
82.55 3.76	82.55 3.25	82.55 4.88	12d
88.90 4.11	88.90 3.43	88.90 5.26	16d
101.60 4.88	101.60 3.76	101.60 5.72	20d
114.30 5.26	114.30 3.76	114.30 6.20	30d
127.00 5.72	127.00 4.11	127.00 6.68	40d
_____	_____	139.70 7.19	50d
_____	_____	152.40 7.19	60d

SUBSTITUTION TABLE FOR IRRIGATION COMPONENTS

METRIC WATER METERS, TRUCK LOADING STANDPIPES, VALVES, BACKFLOW PREVENTERS, FLOW SENSORS, WYE STRAINERS, FILTER ASSEMBLY UNITS, PIPE SUPPLY LINES, AND PIPE IRRIGATION SUPPLY LINES SHOWN ON THE PLANS DIAMETER NOMINAL (DN) mm	NOMINAL SIZE TO BE SUBSTITUTED inch
15	1/2
20	3/4
25	1
32	1-1/4
40	1-1/2
50	2
65	2-1/2
75	3
100	4
150	6
200	8
250	10
300	12
350	14
400	16

Unless otherwise specified, substitutions of United States Standard Measures standard structural shapes corresponding to the metric designations shown on the plans and in conformance with the requirements in ASTM Designation: A 6/A 6M, Annex 2, will be allowed.

8-1.02 STATE-FURNISHED MATERIALS

Attention is directed to Section 6-1.02, "State-Furnished Materials," of the Standard Specifications and these special provisions.

The following materials will be furnished to the Contractor:

A. Sufficient quantities of LPG as required, for testing the respective system.

SECTION 8-2. (BLANK)

SECTION 8-3. (BLANK)

SECTION 9. (BLANK)

SECTION 10. CONSTRUCTION DETAILS

SECTION 10-1. GENERAL

10-1.01 WATER POLLUTION CONTROL

Water pollution control work shall conform to the provisions in Section 7-1.01G, "Water Pollution," of the Standard Specifications and these special provisions.

Water pollution control work shall conform to the requirements in the "Storm Water Pollution Prevention Plan (SWPPP) and Water Pollution Control Program (WPCP) Preparation Manual" and the "Construction Site Best Management Practices (BMPs) Manual," and addenda thereto issued up to, and including, the date of advertisement of the project, hereafter referred to as respectively as the "Preparation Manual" and the "Construction Site BMP Manual" and collectively as the "Manuals." Copies of the Manuals may be obtained from the Department of Transportation, Material Operations Branch, Publication Distribution Unit, 1900 Royal Oaks Drive, Sacramento, California 95815, Telephone: (916) 445-3520. Copies of the Manuals may also be obtained from the Department's Internet Web Site at: http://www.dot.ca.gov/hq/construc/stormwater.html.

Copies of the Manuals are also available for review at the North Region Construction Office, located at 379 Colusa Highway Yuba City, CA 95991.

The Contractor shall know and fully comply with the applicable provisions of the Manuals and Federal, State, and local regulations that govern the Contractor's operations and storm water discharges from both the project site and areas of disturbance outside the project limits during construction.

Unless arrangements for disturbance of areas outside the project limits are made by the Department and made part of the contract, it is expressly agreed that the Department assumes no responsibility whatsoever to the Contractor or property owner with respect to any arrangements made between the Contractor and property owner to allow disturbance of areas outside the project limits.

The Contractor shall be responsible for the costs and for liabilities imposed by law as a result of the Contractor's failure to comply with the requirements set forth in this section "Water Pollution Control" including, but not limited to, compliance with the applicable provisions of the Manuals and Federal, State, and local regulations. For the purposes of this paragraph, costs and liabilities include, but are not limited to, fines, penalties, and damages whether assessed against the State or the Contractor, including those levied under the Federal Clean Water Act and the State Porter Cologne Water Quality Act.

In addition to the remedies authorized by law, an amount of the money due the Contractor under the contract, as determined by the Department, may be retained by the State of California until disposition has been made of the costs and liabilities.

The retention of money due the Contractor shall be subject to the following:

A. The Department will give the Contractor 30 days notice of the Department's intention to retain funds from partial payments which may become due to the Contractor prior to acceptance of the contract. Retention of funds from payments made after acceptance of the contract may be made without prior notice to the Contractor.
B. No retention of additional amounts out of partial payments will be made if the amount to be retained does not exceed the amount being withheld from partial payments pursuant to Section 9-1.06, "Partial Payments," of the Standard Specifications.
C. If the Department has retained funds and it is subsequently determined that the State is not subject to the costs and liabilities in connection with the matter for which the retention was made, the Department shall be liable for interest on the amount retained at the legal rate of interest for the period of the retention.

Conformance with the provisions in this section "Water Pollution Control" shall not relieve the Contractor from the Contractor's responsibilities as provided in Section 7, "Legal Relations and Responsibilities," of the Standard Specifications.

WATER POLLUTION CONTROL PROGRAM PREPARATION, APPROVAL AND UPDATES

As part of the water pollution control work, a Water Pollution Control Program, hereafter referred to as the "WPCP," is required for this contract. The WPCP shall conform to the provisions in Section 7-1.01G, "Water Pollution," of the Standard Specifications, the requirements in the Manuals, and these special provisions.

No work having potential to cause water pollution, as determined by the Engineer, shall be performed until the WPCP has been approved by the Engineer.

Within 30 (thirty) days after the approval of the contract, the Contractor shall submit 3 copies of the WPCP to the Engineer. The Engineer will have 7 (seven) days to review the WPCP. If revisions are required, as determined by the Engineer, the Contractor shall revise and resubmit the WPCP within 7 (seven) days of receipt of the Engineer's comments. The Engineer will have 7 (seven) days to review the revisions. Upon the Engineer's approval of the WPCP, 5 (five) additional copies of the WPCP incorporating the required changes shall be submitted to the Engineer. Minor changes or clarifications to the initial submittal may be made and attached as amendments to the WPCP. In order to allow construction activities to proceed, the Engineer may conditionally approve the WPCP while minor revisions or amendments are being completed.

The WPCP shall identify pollution sources that may adversely affect the quality of storm water discharges associated with the project and shall identify water pollution control measures, hereafter referred to as control measures, to be constructed, implemented, and maintained in order to reduce to the extent feasible pollutants in storm water discharges from the construction site during construction under this contract.

The WPCP shall incorporate control measures in the following categories:

A. Soil stabilization;
B. Sediment control;
C. Tracking control;
D. Wind erosion control;
E. Non-storm water control; and
F. Waste management and material pollution control.

Specific objectives and minimum requirements for each category of control measures are contained in the Manuals.

The Contractor shall consider the objectives and minimum requirements presented in the Manuals for each of the above categories. When minimum requirements are listed for any category, the Contractor shall incorporate into the WPCP and implement on the project, one or more of the listed minimum controls required in order to meet the pollution control objectives for the category. In addition, the Contractor shall consider other control measures presented in the Manuals and shall incorporate into the WPCP and implement on the project the control measures necessary to meet the objectives of the WPCP. The Contractor shall document the selection process in conformance with the procedure specified in the Manuals.

The following contract items of work shall be incorporated into the WPCP as critical temporary control measures: Temporary Straw Bale and Temporary Silt Fence. The Contractor shall consider other control measures to supplement these critical temporary control measures when necessary to meet the pollution control objectives of the WPCP.

The WPCP shall include, but not be limited to, the following items as described in the Preparation Manual:

A. Project description and Contractor's certification;
B. Project information;
C. Pollution sources, control measures, and water pollution control drawings; and
D. Amendments, if any.

The Contractor shall amend the WPCP, graphically and in narrative form, whenever there is a change in construction activities or operations which may affect the discharge of significant quantities of pollutants to surface waters, ground waters, municipal storm drain systems or when deemed necessary by the Engineer. The WPCP shall be amended if the WPCP has not achieved the objective of reducing pollutants in storm water discharges. Amendments shall show additional control measures or revised operations, including those in areas not shown in the initially approved WPCP, which are required on the project to control water pollution effectively. Amendments to the WPCP shall be submitted for review and approval by the Engineer in the same manner specified for the initially approved WPCP. Amendments shall be dated and attached to the on-site WPCP document.

The Contractor shall keep a copy of the WPCP, together with updates, revisions and amendments at the project site.

WPCP IMPLEMENTATION

Upon approval of the WPCP, the Contractor shall be responsible throughout the duration of the project for installing, constructing, inspecting, and maintaining the control measures included in the WPCP and any amendments thereto and for removing and disposing of temporary control measures. Unless otherwise directed by the Engineer or specified in these special provisions, the Contractor's responsibility for WPCP implementation shall continue throughout any temporary suspension of work ordered in conformance with the provisions in Section 8-1.05, "Temporary Suspension of Work," of the Standard Specifications. Requirements for installation, construction, inspection, maintenance, removal, and disposal of control measures are specified in the Manuals and these special provisions.

Soil stabilization practices and sediment control measures, including minimum requirements, shall be provided throughout the rainy season, defined as between October 15 and April 15.

Implementation of soil stabilization practices and sediment control measures for soil-disturbed areas on the project site shall be completed, except as provided for below, not later than 20 days prior to the beginning of the rainy season or upon start of applicable construction activities for projects which begin either during or within 20 days of the rainy season.

Throughout the rainy season, the active, soil-disturbed area of the project site shall be not more than 1.9 hectares. The Engineer may approve, on a case-by-case basis, expansions of the active, soil-disturbed area limit. The Contractor shall demonstrate the ability and preparedness to fully deploy soil stabilization practices and sediment control measures to protect soil-disturbed areas on the project site before the onset of precipitation. A quantity of soil stabilization and sediment control materials shall be maintained on site equal to 125 percent of that sufficient to protect unprotected, soil-disturbed areas on the project site. A detailed plan for the mobilization of sufficient labor and equipment shall be maintained to fully deploy control measures required to protect unprotected, soil-disturbed areas on the project site prior to the onset of precipitation. A current inventory of control measure materials and the detailed mobilization plan shall be included as part of the WPCP.

Throughout the rainy season, soil-disturbed areas on the project site shall be considered to be nonactive whenever soil disturbing activities are expected to be discontinued for a period of 20 or more days and the areas are fully protected. Areas that will become nonactive either during the rainy season or within 20 days thereof shall be fully protected with soil stabilization practices and sediment control measures within 10 days of the discontinuance of soil disturbing activities or prior to the onset of precipitation, whichever is first to occur.

Throughout the rainy season, active soil-disturbed areas of the project site shall be fully protected at the end of each day with soil stabilization practices and sediment control measures unless fair weather is predicted through the following work day. The weather forecast shall be monitored by the Contractor on a daily basis. The National Weather Service forecast shall be used. An alternative weather forecast proposed by the Contractor may be used if approved by the Engineer. If precipitation is predicted prior to the end of the following work day, construction scheduling shall be modified, as required, and functioning control measures shall be deployed prior to the onset of the precipitation.

The Contractor shall implement, year-round and throughout the duration of the project, control measures included in the WPCP for tracking control, wind erosion control, non-storm water control, and waste management and material pollution control.

The Engineer may order the suspension of construction operations which create water pollution if the Contractor fails to conform to the provisions in this section "Water Pollution Control" as determined by the Engineer.

MAINTENANCE

To ensure the proper implementation and functioning of control measures, the Contractor shall regularly inspect and maintain the construction site for the control measures identified in the WPCP. The Contractor shall identify corrective actions and time needed to address any deficient measures or reinitiate any measures that have been discontinued.

The construction site inspection checklist provided in the Preparation Manual shall be used to ensure that the necessary measures are being properly implemented, and to ensure that the control measures are functioning adequately. One copy of each site inspection record shall be submitted to the Engineer.

During the rainy season, inspections of the construction site shall be conducted by the Contractor to identify deficient measures, as follows:

A. Prior to a forecast storm;
B. After all precipitation which causes runoff capable of carrying sediment from the construction site;
C. At 24-hour intervals during extended precipitation events; and
D. Routinely, at a minimum of once every 2 weeks.

If the Contractor or the Engineer identifies a deficiency in the deployment or functioning of an identified control measure, the deficiency shall be corrected immediately. The deficiency may be corrected at a later date and time if requested by the Contractor and approved by the Engineer in writing, but not later than the onset of subsequent precipitation events. The correction of deficiencies shall be at no additional cost to the State.

PAYMENT

Full compensation for conforming to the provisions in this section shall be considered as included in the prices paid for the various contract items of work involved and no additional compensation will be allowed therefor.

Those control measures for which there is a contract item of work will be measured and paid for as that contract item of work.

The Engineer will retain an amount equal to 25 percent of the estimated value of the contract work performed during estimate periods in which the Contractor fails to conform to the provisions in this section "Water Pollution Control" as determined by the Engineer.

Retentions for failure to conform to the provisions in this section "Water Pollution Control" shall be in addition to the other retentions provided for in the contract. The amounts retained for failure of the Contractor to conform to the provisions in this section will be released for payment on the next monthly estimate for partial payment following the date that a WPCP has been implemented and maintained and water pollution is adequately controlled, as determined by the Engineer.

10-1.02 TEMPORARY SILT FENCE

Temporary silt fence shall conform to these special provisions.

Temporary silt fence shall be furnished, installed, maintained, and removed at the locations as directed by the Engineer.

Preparation shall conform to the provisions in Section 20-3.02, "Preparation," of the Standard Specifications.

Attention is directed to "Water Pollution Control" of these special provisions.

MATERIALS

Materials for temporary silt fence shall conform to the provisions in Section 20-2, "Materials," of the Standard Specifications.

Temporary silt fence shall be a prefabricated silt fence with a minimum woven polypropylene fabric width of 900 mm and a minimum tensile strength of 0.44-kN, conforming to the requirements of ASTM Designation: D 4632 and having an integral reinforcement layer. The reinforcement layer shall be a polypropylene or equivalent net provided by the manufacturer.

INSTALLATION

Temporary silt fence shall be installed as directed by the Engineer and in conformance with Detail Sheets 1 and 2 in Appendix C, CD36(2) in the Construction Contractors Guide and Specifications of the Caltrans Storm Water Quality Handbooks.

When joints are necessary, the temporary silt fence shall overlap a minimum of 150 mm with both posts tied together.

Temporary silt fences shall be maintained to provide for adequate sediment holding capacity. Sediment deposits shall be removed when the sediment deposit reaches approximately one-third of the fence height. Removed sediment shall be deposited within the project in such a way that the sediment is not subject to erosion by wind or water, or as directed by the Engineer.

When no longer required for the intended purpose, as determined by the Engineer, temporary silt fence shall be removed from the site of the work.

Holes, depressions or any other ground disturbance caused by the removal of the temporary silt fence shall be backfilled and repaired in conformance with the provisions in the second paragraph of Section 15-1.02, "Preservation of Property," of the Standard Specifications.

MEASUREMENT AND PAYMENT

The quantity of temporary silt fence will be measured by the meter as determined from actual measurements, the measurements to be made parallel with the ground slope along the line of the completed temporary silt fence, deducting the widths of openings.

The contract price paid per meter for temporary silt fence shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in installing temporary silt fence, complete in place, including trench excavation and backfill, and maintenance and removal of temporary silt fence, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Temporary silt fence placed at location other than as shown on the project plans or directed by the Engineer, in conformance with the Contractor's Water Pollution Control Program, will not be measured and will be paid for as specified in "Water Pollution Control" of these special provisions.

No adjustment of compensation will be made for any increase or decrease in the quantities of temporary silt fence required, regardless of the reason for the increase or decrease. The provisions in Section 4-1.03B, "Increased or Decreased Quantities," of the Standard Specifications shall not apply to temporary silt fence.

10-1.03 TEMPORARY STRAW BALE BARRIER

Temporary straw bale barrier shall conform to these special provisions.

Temporary straw bale barrier work shall consist of furnishing, installing, constructing, anchoring, staking, maintaining, and removing bales at the locations shown on the plans.

Preparation shall conform to the provisions in Section 20-3.02, "Preparation," of the Standard Specifications.

Attention is directed to "Water Pollution Control" of these special provisions.

MATERIALS

Straw for straw bales shall conform to the provisions in Section 20-2.06, "Straw," of the Standard Specifications.

Each straw bale shall be a minimum of 360 mm wide, 450 mm in height, 900 mm in length and shall have a minimum mass of 23 kg. The straw bale shall be composed entirely of vegetative matter, except for binding material.

Stakes shall be 50 mm x 50 mm wood posts. Each stake shall have a minimum length of one meter.

Bales shall be bound by either wire, nylon or polypropylene string. Jute and cotton binding shall not be used. Wire shall be a minimum of 1.57 mm (16-gage) baling wire. Nylon or polypropylene string shall be approximately 2 mm in diameter with 360 N of breaking strength.

INSTALLATION

Temporary straw bale barriers shall be installed as shown on the plans and in conformance with Detail Sheet 1 in Appendix C, CD37(2) in the Construction Contractors Guide and Specifications of the Caltrans Storm Water Quality Handbooks.

Bales shall be placed so that the binding wire or string is not in contact with the ground. Bales shall be securely anchored in place by 2 stakes driven through the bales. The first stake in each bale shall be driven toward the previously laid bale to force the bales together.

Temporary straw bale barriers shall be maintained to provide for adequate sediment holding capacity. Sediment deposits shall be removed when the sediment deposit reaches one-third of the straw bale barrier height. Removed sediment shall be deposited within the project in such a way that the sediment is not subject to erosion by wind or water, or as directed by the Engineer. Installed bales shall be removed and replaced as required to adapt to changing conditions.

When no longer required for the intended purpose, as determined by the Engineer, temporary straw bale barrier shall be removed from the site of the work. As an option, the straw bales may be spread on slopes or other areas designated by the Engineer.

Holes, depressions or any other ground disturbance caused by the removal of the temporary straw bale barrier shall be backfilled and repaired in conformance with the provisions in the second paragraph of Section 15-1.02, "Preservation of Property," of the Standard Specifications.

MEASUREMENT AND PAYMENT

Temporary straw bale barrier will be measured by the meter .

The contract price paid per meter for temporary straw bale shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in installing temporary straw bale barriers, complete in place, including maintenance and removal of materials, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Temporary straw bale barriers placed at locations other than as shown on the project plans or directed by the Engineer, in conformance with the Contractor's Water Pollution Control Program, will not be measured and will be paid for as specified in "Water Pollution Control" of these special provisions.

No adjustment of compensation will be made for any increase or decrease in the quantities of temporary straw bale required, regardless of the reason for the increase or decrease. The provisions in Section 4-1.03B, "Increased or Decreased Quantities," of the Standard Specifications shall not apply to temporary straw bale.

10-1.04 EARTHWORK

Earthwork shall conform to the provisions in Section 19, "Earthwork," of the Standard Specifications.

10-1.05 AGGREGATE BASE

Aggregate base shall be Class 2 and shall conform to the provisions in Section 26, "Aggregate Bases," of the Standard Specifications and these special provisions.

The restriction that the amount of reclaimed material included in Class 2 aggregate base not exceed 50 percent of the total volume of the aggregate used shall not apply. Aggregate for Class 2 aggregate base may include reclaimed glass. Aggregate base incorporating reclaimed glass shall not be placed at locations where surfacing will not be placed over the aggregate base.

10-1.06 ASPHALT CONCRETE

This work shall consist of furnishing and placing asphalt concrete in conformance with these special provisions.

Asphalt concrete shall be produced at an established commercial mixing plant. The aggregate and asphalt binder shall be heated and mixed thoroughly.

The maximum size aggregate shall be 19-mm.

Asphalt concrete shall be spread and compacted by methods that will produce an asphalt concrete surfacing true to grade and cross section, of uniform smoothness and texture, compacted firmly and free from depressions, humps or irregularities.

Asphalt concrete to be placed in areas designated on the plans as miscellaneous areas may be spread in one layer to the required line, grade, and cross section and shall be compacted firmly.

Dikes shall be shaped and compacted with equipment that shapes and compacts the material to the required cross section.

Compensation for the work performed under this section "Asphalt Concrete," including the asphalt concrete, dikes, and surfacing miscellaneous areas shall conform to the provisions in Section 39-8.01, "Measurement," and Section 39-8.02, "Payment," of the Standard Specifications.

SECTION 11. (BLANK)

SECTION 12. BUILDING WORK

SECTION 12-1. GENERAL REQUIREMENTS

12-1.01 SCOPE

Building work described herein and as shown on the plans shall conform to the requirements of these special provisions and Sections 1 through 9 of the Standard Specifications. Sections 10 through 95 of the Standard Specifications shall not apply to the work in this Section 12 except when specific reference is made thereto.

The building work to be done consists, in general, of constructing an Equipment/Office Building, Utility Building, Wash Rack and Canopy, Equipment Canopy, Materials Bin and Canopy, including related mechanical, electrical, and sanitary work, and such other items or details, not mentioned above, that are required by the plans, General Conditions, or these special provisions shall be performed, placed, constructed or installed at the Chester Maintenance Station.

12-1.02 ORDER OF WORK

The order of electrical work for energizing the new Main Switchboard shall be as follows:

Power to the existing facility shall be maintained until the new Main Switchboard is ready for energization.

Two weeks written notification shall be given to the Engineer prior to connecting the new Main Switchboard.

The facility shall be de-energized beginning at 5:00 PM on a Friday and be fully functional by 9:00 AM on the following Monday.

During the power switchover process, at the existing Equipment Building, care shall be provided so that the phase sequencing of the new electrical service is the same as phase sequencing of the existing electrical service.

12-1.03 ABBREVIATIONS

Section 1-1.02, "Abbreviations," of the Standard Specifications is amended by adding the following:

AAMA	American Architectural Manufacturers' Association
ACI	American Concrete Institute
AGA	American Gas Association
AITC	American Institute of Timber Construction
AMCA	Air Movement and Control Association
APA	American Plywood Association
ARI	American Refrigeration Institute
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
CBC	California Building Code
CEC	California Electrical Code
CMC	California Mechanical Code
CS	Commercial Standards (US Department of Commerce)
ESO	Electrical Safety Orders
FGMA	Flat Glass Marketing Association
FM	Factory Mutual
FS	Federal Specification
ICBO	International Conference of Building Officials
NAAMM	National Association of Architectural Metal Manufacturers

NBFU	National Board Fire Underwriters
NEC	National Electrical Code
NFPA	National Fire Protection Association
PEI	Porcelain Enamel Institute
PS	Product Standard (US Department of Commerce)
RIS	Redwood Inspection Service
SCPI	Structural Clay Products Institute
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SSPC	Steel Structures Paint Council
TCA	Tile Council of America
TPI	Truss Plate Institute
UBC	Uniform Building Code
UL	Underwriters Laboratories, Inc.
WCLIB	West Coast Lumber Inspection Bureau (stamped WCLB)
WCLB	Grade stamp for WCLIB
WIC	Woodwork Institute of California
WWPA	Western Wood Products' Association

When reference is made to the Uniform Building Code (UBC) on the plans or in the special provisions, it shall be the 1997 Uniform Building Code as amended by the 1998 Title 24 California Building Standards Code.

12-1.04 GUARANTEE

The Contractor hereby unconditionally guarantees that the building work will be done in accordance with the requirements of the contract, and further guarantees the building work of the contract to be and remain free of defects in workmanship and materials for a period of one year from the date of acceptance of the contract, unless a longer guarantee period is required elsewhere in these special provisions. The Contractor hereby agrees to repair or replace any and all building work, together with any other adjacent work which may be displaced in so doing, that may prove to be not in accordance with the requirements of the contract or that may be defective in its workmanship or material within the guarantee period specified, without any expense whatsoever to the Department, ordinary wear and tear and unusual abuse or neglect excepted.

The performance bond for contract price of the building work, shall remain in full force and effect during the guarantee period.

The Contractor further agrees, that within 10 calendar days after being notified in writing by the Department of any building work not in accordance with the requirements of the contract or any defects in the building work, he shall commence and prosecute with due diligence all work necessary to fulfill the terms of this guarantee, and shall complete the work within a reasonable period of time, and, in the event he fails to comply, he does hereby authorize the Department to proceed to have such work done at the Contractor's expense and he shall honor and pay the cost and charges therefor upon demand. The Department shall be entitled to all costs and expenses, including reasonable attorney's fees, necessarily incurred upon the Contractor's refusal to honor and pay the above costs and charges.

12-1.05 COOPERATION

Attention is directed to Sections 7-1.14, "Cooperation," and 8-1.10, "Utility and Non-Highway Facilities," of the Standard Specifications and these special provisions.

Work by State forces will be in progress within the contract limits during the working period for this contract.

The Contractor shall comply with all security policies and normal working hours of the State concerning the Chester Maintenance Station.

The Contractor shall plan his work to minimize interference with State forces and the public. Interruptions to any services for the purpose of making or breaking a connection shall be made only after consultation with and for such time periods as directed by the Engineer.

12-1.06 SUBMITTALS

Working drawings, material lists, descriptive data, samples and other submittals specified in these special provisions shall be submitted for approval in accordance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications and these special provisions.

Unless otherwise permitted in writing by the Engineer, all submittals required by these special provisions shall be submitted within 35 days after the contract has been approved.

Attention is directed to the provisions in Section 5-1.01, "Authority of Engineer," of the Standard Specifications. The Engineer may request submittals for materials or products where submittals have not been specified in these special provisions, or may request that additional information be included in specified submittals, as necessary to determine the quality or acceptability of such materials or products.

Attention is directed to Section 6-1.05, "Trade Names and Alternatives," of the Standard Specifications. The second indented paragraph of the first paragraph of said Section 6-1.05 is amended to read:

> Whenever the specifications permit the substitution of a similar or equivalent material or article, no test or action relating to the approval of such substituted material will be made until the request for substitution is made in writing by the Contractor accompanied by complete data as to the equality of the material or article proposed. Such request shall be made within 35 days after the date the contract has been approved and in ample time to permit approval without delaying the work, but need not be made in less than 35 days after award of the contract.

Work requiring the submittal of working drawings, material lists, descriptive data, samples, or other submittals shall not begin prior to approval of said submittal by the Engineer. Fifteen working days shall be allowed for approval or return for correction of each submittal or resubmittal. Should the Engineer fail to complete his review within the time specified and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in review, an extension of time commensurate with the delay in completion of the work thus caused will be granted as provided in Section 8-1.07, "Liquidated Damages," of the Standard Specifications.

Submittals shall be delivered to the locations indicated in these special provisions. If a specific location is not indicated, the submittal shall be delivered to the Division of Structure Design, Documents Unit, Fourth Floor, Mail Station 9-4/4I, 1801 30th Street, Sacramento, California 95816, telephone (916) 227-8252, or the submittals shall be mailed to the Division of Structure Design, Documents Unit, Mail Station 9-4/4I, P. O. Box 942874, Sacramento, California 94274-0001.

Each submission of drawings, material lists and descriptive data shall consist of at least 5 copies. Two copies will be returned to the Contractor either approved for use or returned for correction and resubmittal.

Each separate item submitted shall bear a descriptive title, the name of the project, district, county, and contract number. Plans and detailed drawings shall be not larger than 559 mm x 914 mm.

The material list shall be complete as to name of manufacturer, catalog number, size, capacity, finish, all pertinent ratings, and identification symbols used on the plans and in the special provisions for each unit.

Parts lists and service instructions packaged with or accompanying the equipment installed in the work shall be delivered to the Engineer at the jobsite. Required operating and maintenance instructions shall be submitted in triplicate.

Manufacturer's warranties for products installed in the work shall be delivered to the Engineer at the jobsite.

Unapproved samples and samples not incorporated in the work shall be removed from State property, when directed by the Engineer.

12-1.07 PROGRESS SCHEDULE

A progress schedule shall be submitted in duplicate for the building work in accordance with the requirements in Section 8-1.04, "Progress Schedule," of the Standard Specifications.

12-1.08 SCHEDULE OF VALUES

The Contractor shall prepare and submit to the Engineer for approval 2 copies of a Schedule of Values within 15 working days of approval of the contract covering each lump sum item for building work. Fifteen working days shall be allowed for approval or return for correction of each submittal or resubmittal. Should the Engineer fail to complete his review within the time specified and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in review, an extension of time commensurate with the delay in completion of the work thus caused will be granted as provided in Section 8-1.07, "Liquidated Damages," of the Standard Specifications.

The Schedule of Values must be accurately divided into sections representing the cost of each separate building or structure. All work that is not part of a separate building or structure, such as excavation, grading, curbs, gutters, sidewalks, paving, sewer and storm drainage and utility distribution lines are to be included under a specific section as General Work and not included in the building or structure cost. Indirect costs and general condition items are to be listed as a separate line item of work. The sections representing each building or structure must be identified as to the building or structure they represent and be broken down to show the corresponding value of each craft, trade or other significant portion of the work. A sub-total for each section shall be provided.

The Schedule of Values shall be approved by the Engineer before any partial payment estimate is prepared.

The sum of the items listed in the Schedule of Values shall equal the contract lump sum price for building work. Overhead, profit and bond premium are to be appropriately distributed across all line items of cost.

12-1.09 INSPECTION

All items covered or all stages of work that are not to remain observable must be inspected and approved before progress of work conceals portions to be inspected. The Contractor shall notify the Engineer not less than 72 hours in advance of when such inspection is needed.

12-1.10 UTILITY CONNECTION

The Contractor shall make all arrangements, and obtain all permits and licenses required for the extension of and connection to each utility service applicable to this project, shall furnish all labor and materials necessary for such extensions which are not performed or provided by the utility, and shall furnish and install any intermediate equipment required by the serving utilities.

Upon written request by the Contractor, the State will pay all utility permits, licenses, connection charges, and excess length charges directly to the utility. Such request shall be submitted not less than 45 days before service connections are required.

The costs incurred by the Contractor for the extensions of utilities beyond the limits shown on the plans, and in furnishing and installing any intermediate equipment required by the serving utilities, will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

Full compensation for any costs incurred by the Contractor to obtain the permits and licenses shall be considered as included in the contract lump sum price paid for building work and no additional compensation will be allowed therefor.

12-1.11 TEMPORARY UTILITIES

The Contractor may obtain electrical power and water from existing State electrical power and water outlets within the contract limits free of charge for contract operations where such utilities exist, provided that such utility services are in service and are not required by the State for other purposes and subject to the provisions in the section "Cooperation" of these special provisions.

The Contractor shall make his own arrangements to obtain any additional electrical power and water or other utilities required for his operations and shall make and maintain the necessary service connections at his own expense.

When existing utility systems are being modified, periods of shutdown will be determined by the Engineer.

The Contractor shall provide adequate temporary lighting to perform the work and allow the Engineer to inspect the project as each portion is completed.

The Contractor shall provide and pay for telephone service he may require. State telephone facilities shall not be used.

12-1.12 SANITARY FACILITIES

When operational, State sanitary facilities will be available for use by the Contractor's employees, during normal State working hours. Tools shall not be cleaned nor shall cleaning liquids be disposed of in State sanitary facilities or sewers.

12-1.13 REFERENCES

When reference is made to the Uniform Building Code (UBC) on the plans or in the special provisions, it shall be the 1997 Uniform Building Code as amended by the 1998 Title 24 California Building Standards Code.

12-1.14 MEASUREMENT AND PAYMENT

The contract lump sum price paid for building work shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the building work, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for any incidental materials and labor, not shown on the plans or specified, which are necessary to complete the buildings and appurtenances shall be considered as included in the contract lump sum price paid for building work and no additional compensation will be allowed therefor.

12-1.15 PROJECT RECORD DRAWINGS

The Contractor shall prepare and maintain one set of project record drawings, using an unaltered set of original project plans, to clearly show all as-constructed information for the project. As a minimum, the information to be shown shall include 1) any plan clarifications or change orders, 2) locations of any underground utilities, or 3) the location, size, type, and manufacturer of all major products or components selected by the Contractor for use in the work.

All markings shall be placed on the project record drawings using red ink or red pencil. Original figures shall not be eradicated nor written over and superseded material shall be neatly lined out. Additional drawings shall be submitted if the required information cannot be clearly shown on the original set of project plans. The additional drawings shall be not less than 279 mm x 432 mm in size and shall have the contract number on each sheet. The Contractor shall sign and date each sheet of the project record drawings to verify that all as-constructed information shown on the drawings is correct.

The Contractor shall periodically review the set of project record drawings with the Engineer during the progress of the work to assure that all changes and other required information are being recorded.

Before completion of the work, the Contractor shall request a review of the project record drawings to determine the completeness and adequacy of them. If the project record drawings are unacceptable, the Contractor shall inspect, measure, and survey the project as necessary to record the required additional information.

The set of completed project record drawings shall be delivered to the Engineer prior to acceptance of the contract.

12-1.16 FIELD ENGINEERING

This section specifies administrative and procedural requirements for field engineering services to be performed by the Contractor.

Lines and grades.--Attention is directed to Section 5-1.07 "Lines and Grades," of the Standard Specifications.

Such stakes or marks will be set by the Engineer as he determines to be necessary to establish the lines and grades required for the completion of the work shown on the plans and as specified in these special provisions. In general, these will consist of the primary vertical and horizontal control points.

Stakes and marks set by the Engineer shall be carefully preserved by the Contractor. In case such stakes and marks are destroyed or damaged they will be replaced at the Engineer's earliest convenience. The Contractor will be charged for the cost of necessary replacement or restoration of such stakes and marks which in the judgment of the Engineer were carelessly or willfully destroyed or damaged by the Contractor's operations. This charge will be deducted from any moneys due or to become due the Contractor.

All other stakes or marks required to establish the lines and grades required for the completion of the work shall be the responsibility of the Contractor.

Existing utilities and equipment.--The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, the Contractor shall investigate and verify the existence and location of underground utilities and other construction.

Prior to construction, the Contractor shall verify the location and invert elevation at points of connection of sanitary and septic sewers, storm sewer, and water or fire service piping.

Surveys for layout and performance.--The Contractor shall perform all surveys for layout and performance, reduce field notes, and make all necessary calculations and drawings necessary to carry out the work.

The Contractor shall locate and layout site improvements, and other work requiring field engineering services, including pavements, stakes for grading, fill and topsoil placement, utility slopes and invert elevations by instrumentation and similar appropriate means.

Batter boards shall be located and laid out for structures, building foundations, column grids and locations, floor levels and, control lines and levels required for mechanical and electrical work.

Survey accuracy and tolerances.--The tolerances generally applicable in setting survey stakes for foundations, slabs, and underground work shall not exceed the following:

Survey Stakes or Markers	Tolerance
Rough grading or excavation	30 mm
Trimming or preparation of subgrade for roadways	15 mm
Roadway surfacing, steel or concrete pipe	6 mm
Structures or building construction	3 mm

Such tolerance shall not supersede stricter tolerances required by the plans or special provisions, and shall not otherwise relieve the Contractor of responsibility for measurements in compliance therein.

12-1.17 SUBSTITUTION OF NON-METRIC MATERIALS AND PRODUCTS

Only materials and products conforming to the requirements of the specifications shall be incorporated in the work. When metric materials and products are not available, and when approved by the Engineer, and at no cost to the State, materials and products in the inch-pound (imperial) system which are of equal quality and of the required properties and characteristics for the purpose intended, may be substituted for the equivalent metric materials and products, subject to the following requirements:

Materials and products shown on the plans or in the special provisions as being equivalent may be substituted for the metric materials and products specified or detailed on the plans.

Before other non-metric materials and products will be considered for use the Contractor shall furnish, at the Contractor's expense, evidence satisfactory to the Engineer that the materials and products proposed for use are equal to or better than the materials and products specified or detailed on the plans. The burden of proof as to the quality and suitability of substitutions shall be upon the Contractor and the Contractor shall furnish all information necessary as required to the Engineer. The Engineer will be the sole judge as to the quality and suitability of the substituted materials and products and the Engineer's decision shall be final.

When the Contractor elects to substitute non-metric materials and products, including materials and products shown on the plans or in the special provisions as being equivalent, a list of substitutions to be made shall be submitted for approval.

The following substitutions of materials and products will be allowed:

SUBSTITUTION TABLE FOR SIZES OF HIGH STRENGTH STEEL FASTENERS, ASTM Designation: A 325M	
METRIC SIZE SHOWN ON THE PLANS mm x thread pitch	IMPERIAL SIZE TO BE SUBSTITUTED inch
M16 x 2	5/8
M20 x 2.5	3/4
M22 x 2.5	7/8
M24 x 3	1
M27 x 3	1-1/8
M30 x 3.5	1-1/4
M36 x 4	1-1/2

SUBSTITUTION TABLE FOR REINFORCEMENT	
METRIC BAR DESIGNATION NUMBER AS SHOWN ON THE PLANS	IMPERIAL BAR DESIGNATION NUMBER TO BE SUBSTITUTED
10	3
13	4
16	5
19	6
22	7
25	8
29	9
32	10
36	11
43	14
57	18

SUBSTITUTION TABLE FOR WELDED PLAIN WIRE REINFORCEMENT, ASTM DESIGNATION: A 185	
	US CUSTOMARY UNITS SIZE TO BE SUBSTITUTED $inch^2$ x 100
MW9	W1.4
MW10	W1.6
MW13	W2.0
MW15	W2.3
MW19	W2.9
MW20	W3.1
MW22	W3.5
MW25	W3.9, except W3.5 in piles only
MW26	W4.0
MW30	W4.7
MW32	W5.0
MW35	W5.4
MW40	W6.2
MW45	W6.5
MW50	W7.8
MW55	W8.5, except W8.0 in piles only
MW60	W9.3
MW70	W10.9, except W11.0 in piles only
MW80	W12.4
MW90	W14.0
MW100	W15.5

The sizes in the following tables of materials and products are exact conversions of metric sizes of materials and products and are listed as acceptable equivalents:

CONVERSION TABLE FOR SIZES OF: (1) STEEL FASTENERS FOR GENERAL APPLICATIONS, ASTM Designation: A 307 or AASHTO Designation: M 314, Grade 36 or 55, and (2) HIGH STRENGTH STEEL FASTENERS, ASTM Designation: A 325 or A 449	
DIAMETER	
METRIC SIZE SHOWN ON THE PLANS mm	EQUIVALENT IMPERIAL SIZE inch
6, or 6.35	1/4
8 or 7.94	5/16
10, or 9.52	3/8
11, or 11.11	7/16
13 or 12.70	1/2
14, or 14.29	9/16
16, or 15.88	5/8
19,or 19.05	3/4
22, or 22.22	7/8
24, 25, or 25.40	1
29, or 28.58	1-1/8
32, or 31.75	1-1/4
35, or 34.93	1-3/8
38 or 38.10	1-1/2
44, or 44.45	1-3/4
51, or 50.80	2
57, or 57.15	2-1/4
64, or 63.50	2-1/2
70 or 69.85	2-3/4
76, or 76.20	3
83, or 82.55	3-1/4
89 or 88.90	3-1/2
95, or 95.25	3-3/4
102, or 101.60	4

CONVERSION TABLE FOR NOMINAL THICKNESS OF SHEET METAL			
UNCOATED HOT AND COLD ROLLED SHEETS		HOT-DIPPED ZINC COATED (GALVANIZED) SHEETS	
METRIC THICK-NESS SHOWN ON THE PLANS mm	EQUIVA-LENT US STAND-ARD GAGE inch	METRIC THICK-NESS SHOWN ON THE PLANS mm	EQUIVA-LENT GALVAN-IZED SHEET GAGE inch
7.94	0.3125		
6.07	0.2391		
5.69	0.2242		
5.31	0.2092		
4.94	0.1943		
4.55	0.1793		
4.18	0.1644	4.270	0.1681
3.80	0.1495	3.891	0.1532
3.42	0.1345	3.510	0.1382
3.04	0.1196	3.132	0.1233
2.66	0.1046	2.753	0.1084
2.28	0.0897	2.372	0.0934
1.90	0.0747	1.994	0.0785
1.71	0.0673	1.803	0.0710
1.52	0.0598	1.613	0.0635
1.37	0.0538	1.461	0.0575
1.21	0.0478	1.311	0.0516
1.06	0.0418	1.158	0.0456
0.91	0.0359	1.006 or 1.016	0.0396
0.84	0.0329	0.930	0.0366
0.76	0.0299	0.853	0.0336
0.68	0.0269	0.777	0.0306
0.61	0.0239	0.701	0.0276
0.53	0.0209	0.627	0.0247
0.45	0.0179	0.551	0.0217
0.42	0.0164	0.513	0.0202
0.38	0.0149	0.475	0.0187

CONVERSION TABLE FOR WIRE		
METRIC THICKNESS SHOWN ON THE PLANS mm	EQUIVALENT USA STEEL WIRE THICKNESS inch	GAGE NO.
6.20	0.244	3
5.72	0.225	4
5.26	0.207	5
4.88	0.192	6
4.50	0.177	7
4.11	0.162	8
3.76	0.148	9
3.43	0.135	10
3.05	0.120	11
2.69	0.106	12
2.34	0.092	13
2.03	0.080	14
1.83	0.072	15
1.57	0.062	16
1.37	0.054	17
1.22	0.048	18
1.04	0.041	19
0.89	0.035	20

CONVERSION TABLE FOR COMMON NAILS				
NAIL SIZE	METRIC mm		ENGLISH inch	
	Length	Diameter	Length	Diameter
8d	63.5	3.33	2 1/2	0.131
10d	76.2	3.76	3	0.148
16d	88.9	4.11	3 1/2	0.162

CONVERSION TABLE FOR LUMBER	
METRIC NOMINAL SURFACE DRY SIZE mm	EQUIVALENT NOMINAL SURFACE DRY U S SIZE inch
51	2
102	4
152	6
203	8
254	10
305	12

CONVERSION TABLE FOR PLYWOOD	
METRIC mm	ENGLISH inch
6.4	1/4
7.9	5/16
9.5	3/8
11.1	7/16
11.9	15/32
12.7	1/2
15.1	19/32
15.9	5/8
18.3	23/32
19.1	3/4
22.2	7/8
25.4	1
28.6	1 1/8

CONVERSION TABLE FOR INSULATION R-VALUE	
METRIC (K m^2/W)	ENGLISH (HR FT^2 F/BTU)
0.5	3
0.7	4
1.4	8
1.9	11
2.3	13
2.5	14
3.3	19
5.3	30

CONVERSION TABLE FOR VAPOR TRANSMISSION RATING	
METRIC (Perm-m)	ENGLISH (perm-inch)
0.29	0.02

CONVERSION TABLE FOR LOW PRESSURE	
METRIC (Pa)	ENGLISH (Inches of Water Column)
30	0.125
60	0.25
90	0.375
120	0.50
150	0.60
155	0.625
175	0.70
185	0.75
200	0.80
250	1.00
310	1.25

CONVERSION TABLE FOR PRESSURE	
METRIC (kPa)	ENGLISH (psi)
10	1.5
210	30
280	40
350	50
690	100
860	125
1040	150
1100	160
1210	175
1380	200
1730	250
2070	300
2170	315
2410	350
2590	375
2760	400
4830	700
5170	750
5520	800
13800	2000
17200	2500
20700	3000
27600	4000
34500	5000
137900	20000

CONVERSION TABLE FOR MIL THICKNESS	
METRIC (mm)	ENGLISH (inch/1000)
0.10	4
0.13	5
0.15	6
0.50	20
0.75	30
1.00	40

CONVERSION TABLE FOR HVAC DUCTING.	
METRIC (mm)	ENGLISH (inch)
100	4
125	5
150	6
175	7
200	8
225	9
250	10
300	12
360	14
410	16
460	18
510	20
560	22
610	24
660	26
710	28
760	30

CONVERSION TABLE FOR MECHANICAL PIPING		
METRIC (GSP, PVC, BSP, DUCTILE IRON)	METRIC (mm)	ENGLISH (inch)
NPS 1/2	15	1/2
NPS 3/4	20	3/4
NPS 1	25	1
NPS 1 1/4	32	1 1/4
NPS 1 1/2	40	1 1/2
NPS 2	50	2
NPS 2 1/2	65	2 1/2
NPS 3	75	3
NPS 4	100	4
NPS 6	150	6

CONVERSION TABLE FOR LUBRICATION PIPING TUBING WALL THICKNESS	
METRIC (mm)	ENGLISH (inch)
2.1	0.083
0.9	0.035

CONVERSION TABLE FOR HOSE/TUBING SIZES O. D.	
METRIC (mm)	ENGLISH (inch)
6	1/4
10	3/8
13	1/2
16	5/8
19	3/4
22	7/8
25	1

CONVERSION TABLE FOR DRUM SIZES			
METRIC		ENGLISH	
L	kg	gallons	pounds
205	180	55	400
60	55	16	120
19	16	5	35

CONVERSION TABLE FOR POWER	
METRIC (kW)	ENGLISH (HP)
0.037	1/20
0.075	1/10
0.18	1/4
0.25	1/3
0.37	1/2
0.55	3/4
0.75	1
1.1	1 1/2
1.5	2
2.2	3
3.7	5
5.5	7 1/2
7.5	10
11	15
15	20
18.5	25
22	30
30	40
37	50
45	60
55	75
75	100
90	120
110	150

CONVERSION TABLE FOR IMPELLER BALANCE		
SYNCHRONOUS RPM	METRIC (g mm/kg)	ENGLISH (ounce-inch/pound)
720	94	0.059
900	73	0.046
1200	54	0.034
1800	41	0.026
3600	17	0.011

CONVERSION TABLE FOR ELECTRICAL CONDUIT	
METRIC SIZE SHOWN ON THE PLANS mm	EQUIVALENT IMPERIAL SIZE inch
16	1/2
21	3/4
27	1
35	1 1/4
41	1 1/2
53	2
103	4

SECTION 12-2. SITEWORK

12-2.01 RELOCATING EQUIPMENT

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of relocating existing equipment in accordance with the details shown on the plans and these special provisions.

PART 2.- PRODUCTS (Not applicable)

PART 3.- EXECUTION

RELOCATION.--

General.--Equipment to be relocated shall be removed carefully to avoid damage to the equipment or to the equipment which is to remain. Assemblies to be relocated which require dismantling for removal shall be matchmarked before dismantling.

The Contractor shall notify the Engineer prior to the relocation work in order that the equipment may be inspected for existing damage.

Equipment which is damaged by the Contractor's operations shall be replaced or restored to match the condition of the equipment prior to the beginning of the Contractor's operations. Replacement or restoration of damaged equipment shall be at the Contractor's expense.

Assemblies which have been dismantled shall be reassembled to match the existing installation. Relocated equipment shall be installed as required for new work.

DISPOSAL.--

General.--Materials from existing facilities to be reused in the work, in the opinion of the Engineer, is unsuitable for use shall become the property of the Contractor and disposed of as provided in Section 7-1.13, "Disposal of Material Outside of the Highway Right of Way." of the Standard Specifications. The unsuitable material shall be replaced as ordered by the Engineer and will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications.

12-2.02 EARTHWORK FOR BUILDING WORK

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of performing earthwork for building work in accordance with the details shown on the plans and these special provisions.

Earthwork for building work shall consist of structure excavation and structure backfill. Structure excavation shall include excavation for footings, foundations, slabs, oil/water separator, lift station. and trenches. Structure backfill shall include backfilling under slabs; backfilling under and around footings; backfilling for pipes and conduits. In addition to structure excavation and structure backfill, earthwork for building work shall include any other earthwork, not mentioned, but necessary to complete the building work.

Attention is directed to the requirements of "Field Engineering" in Section 12-1, "General Requirements," of these special provisions.

QUALITY ASSURANCE.--

Samples.--Samples of sand, pea gravel, or crushed stone, weighing not less than 11 kg, shall be submitted to the Engineer at the jobsite for approval.

SITE CONDITIONS.--

Existing underground piping and conduit.--The location of existing underground piping and conduit is based on the best records available. Before beginning work, the Contractor shall accurately locate the piping and conduit involved in the work. If the location of the existing piping or conduit deviates from the location shown on the plans by more than 1.5 meters, or, if no elevations are indicated and the piping or conduit is more than 0.9 meter below grade, the cost of the additional excavation, backfill, piping or conduit, and removal and replacement of concrete, if any, will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

Existing surfaced or planted areas.--Existing surfaced or planted areas that are removed, broken or damaged by the Contractor's operations shall be restored to their original condition except as otherwise shown on the plans or specified herein.

Restoration materials shall be equal to or better than the original materials. Surfacing shall be replaced to match the material thickness, grades, and finish of the adjacent surrounding surfaces.

PART 2.- PRODUCTS

BACKFILL MATERIALS.--

Structure backfill.--

Structure and trench backfill shall be free of organic and other deleterious material and shall be suitable for the required compaction. Gravel without sand matrix shall not be used except as free draining granular material beneath slabs and footings.

Sand.--

Sand shall be clean, washed sand, free from clay or organic material graded such that 100 percent passes the 6 mm sieve, 90 percent to 100 percent passes the 4.75 mm sieve and not more than 5 percent passes the 75 μm sieve size.

Pea gravel (naturally rounded).--

Pea gravel (naturally rounded) shall be clean, washed, dry density of not less than 1522 kg/m^3, free from clay or organic material and shall conform to the following grading as determined by California Test 202:

Sieve or Screen Size	Percentage Passing
19 mm	100
13 mm	90-100
9.5 mm	40-70
4.75 mm	0-15
2.36 mm	0-3

Pea gravel shall conform to the following requirements:

Test	California Test No.	Test Requirements
Durability Index	229	35 Min.

Crushed stone.--

Crushed stone shall be clean, washed, dry density of not less than 1522 kg/m^3, crushed stone or crushed gravel with an angular particle size not less than 3 mm or more than 13 mm.

Sieve or Screen Size	Percentage Passing
13 mm	100
9.5 mm	85-100
4.75 mm	10-30
2.36 mm	0-3

Crushed stone shall conform to the following requirements:

Test	California Test No.	Test Requirements
Durability Index	229	35 Min.

PART 3.- EXECUTION

PREPARATION & RESTORATION.--

Sawcutting.--Prior to excavation or trenching, existing surfacing shall be removed to saw cut lines, or to existing wood dividers or expansion joints, if any. The saw cut shall be to a neat line and have a depth not less than 25 mm.

Restoration.-Surfacing shall be replaced to match the thickness, grades and finish of the adjacent surrounding surfaces.

STRUCTURE EXCAVATION.--

General.--Unless otherwise noted, all excavation for building work shall be classified as structure excavation.

Footing excavation.--The bottom of excavation shall not be disturbed. The contractor shall excavate by hand to the final grade. The bottom of concrete footings shall be poured against undisturbed material. Unless otherwise noted, compaction of the bottom of footing excavation is not required unless the material is disturbed. The footing depths shown on the plans shall be changed to suit field conditions when directed by the Engineer. Solid rock at or near required depths shall not be disturbed. Unsuitable material shall be excavated down to firm bearing as directed by the Engineer. Work and materials required because of excavation in excess of the depths shown on the plans, when such excavation has been ordered by the Engineer, will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

Excavate to the elevations and dimensions within a tolerance of ±12 mm. Limits of the excavation shall allow for adequate working space for installing materials and as required for safety of personnel. Such working space excavation shall be replaced in kind and compacted at the Contractor's expense.

Overdepth excavation for footings shall be backfilled with concrete or such other material recommended by the Contractor and approved by the Engineer. Relative compaction shall be not less than 95 percent.

Excavation for pipes and conduits.--Pipes or conduits in the same trench shall have a minimum clear distance between pipes or conduits of 150 mm. Pipes or conduits shall have not less than 0.75 meter of cover from top of pipes or conduits to finished grade unless otherwise shown on the plans or specified.

Trenching shall be of sufficient depth to permit placing a minimum depth of 100 mm of compacted sand under all pipes and conduits.

Excavation adjacent to trees shall be performed by hand methods where necessary to avoid injury to trees and roots. Roots 50 mm in diameter and larger shall be protected with heavy burlap. Roots smaller than 50 mm in diameter adjacent to trees shall be hand trimmed. Cuts through roots 13 mm in diameter and larger shall be sealed with tree trimmers' asphaltic

emulsion. If trenches remain open more than 24 hours, the side of the trench adjacent to the tree shall be shaded with burlap and kept damp. Materials shall not be stockpiled within the drip line of trees.

Dewatering.--Excavations shall be kept clear of standing water. Water shall be removed by pumping if necessary. Water removed from excavation shall be carried away from the building site and disposed of in a manner that will not harm State or adjacent property.

STRUCTURE BACKFILLING.--

General.--Unless otherwise noted, all backfill for building work shall be classified as structure backfill. Backfill shall be placed and compacted in horizontal layers, not more than 150 mm thick prior to compaction, and to the lines and grades shown on the plans or to original ground.

Structure backfill.--After structures are in place and forms are removed, wood and other debris shall be removed from excavations before placing structure backfill.

Backfilling pipes and conduits.--Backfill placed under pipe and conduits shall be compacted sand, 100 mm minimum depth. Backfill material placed to a level 150 mm above tops of pipes and conduits shall be sand or fine earth and particles shall not exceed 13 mm in greatest dimension. For wrapped, coated, or plastic pipe or conduits, sand shall be used for backfill. Backfill material placed higher than 150 mm above tops of pipes or conduits shall consist of material free of stones or lumps exceeding 100 mm in greatest dimension except:

(a) The top 300 mm of backfill under roads, walks or paving shall consist of aggregate base material.
(b) The top 150 mm of backfill in planted areas shall consist of topsoil.

COMPACTION.--

General.--Relative compaction shall be determined in accordance with California Test 216 or 231.
Unless otherwise noted below, all backfill shall be compacted to a minimum relative compaction of 90 percent.
Unless approved in writing by the Engineer, compaction by jetting or ponding will not be permitted.

Compact original ground.--Original ground surface under fill with surfacing of concrete and asphalt concrete shall be compacted to a relative compaction of not less than 95 percent for a minimum depth of 150 mm.

Subgrade preparation.--Preparation of subgrade material for placing aggregate base, surfacing, or slabs thereon shall include fine grading, compaction, reworking as necessary. The upper 150 mm of the subgrade shall have the same compaction as the fill to be placed over it.

Structure backfill.--Structure backfill shall be compacted to not less than 95 percent relative compaction.

Trench backfill.--Trench backfill placed beneath slabs or paved areas shall be compacted to a relative compaction of not less than 95 percent.

DISPOSAL.--

Surplus material.--Surplus material from the excavation shall be removed and disposed of outside the right-of-way in accordance with Section 7-1.13 of the Standard Specifications.

FIELD QUALITY CONTROL.--

Inspection.--When the excavation is substantially completed to grade, the Contractor shall notify the Engineer. No concrete shall be placed until the foundation has been approved by the Engineer.

Testing.--The State will conduct compaction tests during the backfilling and compacting operations.

12-2.03 AGGREGATE BASE

PART 1.-GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing, spreading and compacting aggregate base in accordance with the details shown on the plans and these special provisions.

PART 2.-PRODUCTS

Aggregate base.--

Aggregate base shall be commercial quality aggregates consisting of broken stone; crushed gravel; natural, clean, rough-surfaced gravel and sand; or a combination thereof.

Aggregate base shall conform to the following grading as determined by California Test 202:

Sieve or Screen Size	Percentage Passing
25 mm	100
19 mm	90 - 100
4.75 mm	35 - 60
600 µm	10 - 30
75 µm	2 - 9

Aggregate base shall also conform to the following quality requirements:

Tests	California Test No.	Test Requirements
Durability Index	229	35 Min.
Resistance (R-Value)	301	78 Min.
Sand Equivalent	217	22 Min.

PART 3.-EXECUTION

SPREADING AND COMPACTING.--

Spreading.--Aggregate base shall be placed and compacted to the lines and grades shown on the plans.
Spreading and compacting shall be performed by methods that will produce a uniform base, free from pockets of coarse or fine material.

Compaction.--Relative compaction of each layer of compacted base material shall be not less than 95 percent, as determined by California Test 216 or 231.

12-2.04 FREE DRAINING GRANULAR MATERIAL

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and placing free draining granular material beneath slabs in accordance with the details shown on the plans and these special provisions.

PART 2.- PRODUCTS

Free draining granular material.--

Free draining granular material shall be clean, hard, durable, free-draining rock. The material gradation shall be such that all passes the 25 mm screen, and not more than 10 percent passes the 4.75 mm sieve as determined by California Test 202. Granular material shall be free from organic material, clay balls or other deleterious substances.

PART 3.- EXECUTION.--

SPREADING AND CONSOLIDATING.--

General.--Free draining granular material shall be placed, spread and consolidated by tamping or vibrating.

12-2.05 TERMITE CONTROL

PART 1.-GENERAL.--

SUMMARY.--

Scope.--This work shall consist of furnishing and applying soil treatment for termite control in accordance with these special provisions.

SUBMITTALS.--

Product data.--Product labels for the soil treatment material showing descriptive information on the active chemical ingredients, mixing instructions for concentration levels, directions for use, application rates, and precautionary information shall be submitted for approval. Labels shall include an EPA product registration number.

QUALITY ASSURANCE.--

Attention is directed to Section 7-1.01H, "Use of Pesticides," of the Standard Specifications.

Soil treatment operations for control of termites shall be performed by a pest control operator who is licensed by the State of California.

Insecticides used in termite control work shall be approved and registered by the United States Environmental Protection Agency (EPA) and the State of California.

DELIVERY, HANDLING AND STORAGE.--

General.--The storage, mixing and application of chemicals; the cleaning of equipment; and the disposal of product containers shall be in accordance with federal, state and local regulations.

PART 2.-PRODUCTS

Soil treatment material.--

Soil treatment materials for termite control shall be commercial quality and shall be water emulsifiable.

The active chemical ingredient of the termiticide shall be any EPA approved chemical or combinations of chemicals intended for the eradication and control of subterranean termites.

All product containers shall bear the manufacturer's EPA approved label with EPA registration number.

PART 3.-EXECUTION

PREPARATION.--

General.--The Engineer shall be notified not less than 3 working days in advance of the planned termite control work. Similar notice shall be given to any state or local agency which requires that their representative be present during the termite control work.

Soil preparation.--Excavation, embankment construction, backfilling and grading operations shall be completed prior to the application of the soil treatment solution. Deleterious matter that will decrease the effectiveness of the treatment shall be removed from all areas to be treated.

Soil to be treated, except under slabs and foundations and vertical surfaces of trenches, shall be cultivated a minimum of 50 mm in depth, and shall be graded as shown on the plans.

Termite control work shall be performed in the presence of the Engineer unless the Contractor has received written approval from the Engineer to proceed.

MIXING.--

General.--The soil treatment emulsion shall be mixed in accordance with the manufacturer's instructions to achieve the chemical concentration level shown on the EPA approved product label for the type of soil and the area to be treated.

APPLICATION.--

General.--The soil treatment emulsion shall be applied to all soil within the area of the building including floor slab areas, under foundations and footings, to the horizontal and vertical surfaces of excavations and to such other areas or surfaces, not mentioned, but which are required for the complete and total protection of the building. The application shall be in accordance with the instructions shown on the EPA approved product label.

Where free draining material has previously been placed, sufficient amount of dilution shall be added to reach the soil beneath the free draining material.

Treated areas that are subsequently excavated, graded, trenched or filled shall be given an additional application.

PROTECTION.--

General.--Treated areas shall be protected in accordance with the instructions shown on the EPA approved product label until the treated surface is covered by subsequent construction.

If concrete slab cannot be placed over the soil the same day it has been treated, a vapor barrier shall be placed over the treated area to prevent disturbance of the treated soil.

12-2.06 CAST-IN-DRILLED-HOLE CONCRETE PILES

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of constructing cast-in-drilled-hole concrete piles in accordance with the details shown on the plans and these special provisions.

PART 2.-PRODUCTS

Concrete and reinforcement.--

Concrete and reinforcement shall conform to the requirements specified under "Cast-In-Place Concrete" in Section 12-3, "Concrete and Reinforcement," of these special provisions.

PART 3.-EXECUTION

CONSTRUCTION.--

Drilling holes.--All holes for concrete piles shall be drilled to the tip elevations or depths shown on the plans. All holes shall be examined for straightness and any hole which on visual inspection from the top shows less than 1/2 the diameter of the hole at the bottom of the hole shall be rejected. Suitable casings shall be furnished and placed when required to prevent caving of the hole.

All loose material existing at the bottom of the hole after drilling operations have been completed shall be removed before placing concrete in the hole.

Material resulting from drilling holes shall be wasted on the job site as directed by the Engineer.

Surface water shall not be permitted to enter the hole and all water which may have infiltrated into the hole shall be removed before placing concrete therein.

Placing reinforcement.--The reinforcing cage shall be placed and secured symmetrically about the center of the pile and shall be securely blocked to clear the sides of the hole.

Longitudinal reinforcing steel shall be continuous for the entire length of pile, including pile extensions.

Placing concrete.--The concrete filling shall be vibrated to a dense and homogeneous condition. Concrete placed in drilled holes shall be placed against undisturbed material except when portions of the pile will be exposed to view. Surfaces exposed to view and adjacent surfaces within 250 mm of finished grade shall be formed.

Casing, if used in drilling operations, shall be removed from the hole as concrete is placed therein. The bottom of the casing shall be maintained not more than 1.5 meter nor less than 0.3 meter below the top of the concrete during withdrawal and placing operations, unless otherwise permitted by the Engineer. Separation of the concrete during withdrawal operations shall be avoided by hammering or otherwise vibrating the casing.

Formed surfaces shall conform to the requirements specified under "Cast-In-Place Concrete" in Section 12-3, "Concrete and Reinforcement," of these special provisions.

12-2.07 PAINTED PAVEMENT MARKINGS

PART 1.- GENERAL.--

Scope.--This work shall consist of furnishing and applying paint for pavement markings in accordance with the details shown on the plans and these special provisions.

Pavement markings include, but are not limited to, word and symbol markings, and parking stall markings.

PART 2.- PRODUCTS.--

Paint.--

Paint shall be top commercial quality for pavement marking, formulated for the use intended, and manufactured by a nationally recognized manufacturer of paint and other coating products.

The kind of paint to be used (solvent or water borne) shall be determined by the Contractor, based on local air pollution control regulations and weather conditions.

PART 3.- EXECUTION.--

ALIGNMENT AND LAYOUT.--All necessary alignment and layout work shall be performed by the Contractor, in a manner that will not damage the pavement.

Unless otherwise shown on the plans, the width of parking stall markings shall be 105 mm.

EQUIPMENT AND OPERATION.--Mechanical means shall be used to paint pavement markings.

All equipment used in the application of paint shall produce pavement markings of uniform quality.

All spray equipment shall be the proper type and of adequate capacity for the work involved.

Air atomized spray equipment shall be equipped with oil and water extractors and pressure regulators, and shall have adequate air volume and compressor recovery capacity. Spray gun tip needle assemblies and orifices shall be the proper size.

Rapid dry paint shall be applied only with airless type equipment.

Stencils and hand spray equipment shall be used to paint word and symbol markings. Stencils shall be furnished by the Contractor. The stencil layout shall conform to the dimensions shown on the plans.

SURFACE PREPARATION.--Surfaces which are to receive paint shall be cleaned of all dirt and loose material.

APPLICATION.--Paint shall be applied only on dry surfaces, and only during periods of favorable weather, in accordance with the manufacturer's recommendations.

On new surfacing, paint shall be applied in 2 coats. The first coat shall be dry before application of the second coat is applied.

On existing surfacing, paint shall be applied in one coat.

Completed pavement markings shall have clean and well-defined edges, and shall conform to the dimensions shown on the plans or as specified in these special provisions.

Drips, oversprays, improper markings, and paint material tracked by traffic shall be immediately removed from the pavement by methods approved by the Engineer. All such removal shall be at the Contractor's expense.

If used, striping tape shall be applied in accordance with the manufacturer's specifications.

APPLICATION RATES.--Each application of paint shall be applied at the rates recommended by the paint manufacturer for the type of surface involved.

PROTECTION.--Newly placed pavement markings shall be protected from damage by traffic or other causes until the paint is thoroughly dry.

DISABLED ACCESSIBLE PARKING STALL SYMBOL.--Each parking space reserved for persons with physical disabilities shall have a minimum 0.9 m x 0.9 m surface identification with the international symbol of accessibility. The symbol and border shall be white and the background shall be blue conforming to Federal Standard 595B, Color No. 15090.

12-2.08 DESTROY WELL

GENERAL.—

This work shall consist of destroying a water well in accordance with the details shown on the plans and these special provisions

REGULATIONS

The well shown on the plans to be destroyed shall be backfilled with an impervious sealing or filler material in accordance with the requirements for the destruction of water wells in the current issue of the California Department of Water Resources Bulletin No. 74 and the following:

Sealing materials shall be neat cement, cement grout, concrete, bentonite clays, silt and clays, well proportioned mixes of silts, sands, and clays (or cement), or native soils and natural material having a coefficient of permeability of less than 30 meters per year. Used drilling muds shall not be used.

Neat cement shall be composed of portland cement and clean water. The water content of the neat cement shall be between 17 and 25 liters per 43 kg of cement. Cement grout shall be composed of water, one part cement and not more than 2 parts of sand. The water content of the cement grout shall be the same as for neat cement above. Concrete shall be commercial quality concrete with not less than 325 kilograms of cement per cubic meter.

Filler materials shall be clay, silt, sand, gravel, crushed stone, native soils, or mixture thereof. Material containing organic matter shall not be used.

The existing well shall be filled with native or other approved materials from the bottom of the well to a depth of 6 meters below ground surface and with neat cement, cement grout, or concrete from a depth of 6 meters to a depth of 1.5 meters.

Any casing within 1.5 meters of the ground surface at the time of destruction shall be cut off, removed and disposed of and the well sealing material shall be allowed to spill over the top of the cut-off casing into the surrounding excavation to form a cap at least 300 mm thick.

After the upper sealing material has set, the remaining portion of the existing well or excavation shall be filled and graded with native materials.

WELL PERMIT

The Contractor shall make all arrangements and obtain a well permit from the Plumas County Environmental Health Department (530) 283-6355 at a cost of $175.00.

DESTROY WELL

The well shown on the plans to be destroyed shall have existing appurtenances, including motor, pump and piping, removed and disposed of.

The well casing is 203 mm in diameter and approximately 32 meters in depth. The existing well pump is a submersible turbine type pump. Oil in the well casing shall be properly removed and disposed of in accordance with the rules and regulations of the enforcing agency.

12-2.09 SANITARY SEWAGE DISPOSAL SYSTEM

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing, installing and constructing a sanitary sewage system in accordance with the details shown on the plans and these special provisions.

Sanitary sewage system shall include other fittings and appurtenances, not mentioned, which are required for the complete installation and proper operation of the system.

Related work.--Sewer pipes in buildings and to a point 1.5 meters beyond the building shall be as specified in Section 12-15, "Mechanical," of these special provisions.

Order of work.--Work which will curtail the use of the existing sewage system shall not be done until the facilities utilizing the system are closed and are no longer required.

SUBMITTALS.--

Product data.--Materials list for materials to be used shall be submitted for approval and shall include the name of the manufacturer and the source, model number, description, and standard of manufacture.

Manufacturer's descriptive data and catalog cuts shall be submitted for the following:

Underground tracer tape
Sewer pipe and fittings
Sewer pipe adapters
Drain pipe and fittings
Force main pipe
Rectangular manhole frame and cover
Meter box
Assist access cover
Cleanouts
Force main cleanouts

QUALITY ASSURANCE.--

Codes and standards.--All sanitary sewage work shall conform to the applicable portions of the 1997 Uniform Plumbing Code, as amended by the 1998 Title 24 California Building Standards Code, pertaining to the selection and installation of sanitary sewage system materials and products.

Certificates of Compliance.--Certificates of Compliance shall be furnished for manhole covers and frames in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

PART 2.- PRODUCTS

IDENTIFICATION.--

Underground tracer tape.--

Underground tracer tape shall be permanent, bright colored, continuous printed plastic tape with integral metallic strip or wire, intended for direct burial service; not less than 50 mm wide; lettering shall read "CAUTION SEWER BURIED BELOW".

PIPES AND PIPE FITTINGS.--

General.--Provide pipes of one of the following materials, of weight and class indicated. Provide pipe fittings and accessories of same material and weight and class as pipes, with joining method as indicated.

Sewer and drain pipe.--

Sewer and drain pipe and fittings shall be polyvinyl chloride (PVC) gravity sewer plastic pipe and fittings conforming to ASTM Designation: D 3034, Standard Dimension Ratio (SDR) 35, with integral bell and bell and spigot rubber gasketed joints or conforming to ASTM Designation: D 2665 with solvent welded fittings. Rubber gaskets shall conform to ASTM Designation: F 477. Stainless steel clamps with rubber boots shall not be used.

Pipe adapters.--

Pipe adapters for PVC to cast iron soil pipe or clay piping shall be appropriately sized PVC flexible coupling manufactured for connecting dissimilar pipes. Adapters shall be attached to piping with adjustable stainless steel band clamps with hex tightening screws. Rubber boots will not be allowed. Pipe adapter shall be Indiana Seal; Fernco; or equal.

Force main pipe.--

Force main sewer pipe shall be polyvinyl chloride (PVC) plastic pipe, Schedule 80, conforming to ASTM Designation: 1785. Connections shall be threaded and/or slip pipe as shown on the plans.

METER BOXES.--

Meter box and cover --Meter box and cover shall be precast concrete with cast iron cover. Cover shall be factory marked "SEWER," "SS," or "SANITARY SEWER" and shall be traffic rated where shown on the plans. Meter box and cover shall be Bes, No. C9W with C15 cover; Christy, No. B9 with B9C cover; Cook Concrete Products, No. 14 with 14-T cover; or equal.

Meter box for oil/water separator shall be the size as shown on the plans.

Rectangular manhole cast iron cover.--

Rectangular manhole cast iron cover and shall be gray cast iron conforming to ASTM Designation: A 48, Class 30B or greater (traffic type). Cover shall be no bolt, gas tight, closed pick hole and shall be factory marked "SS," "SEWER," or "SANITARY SEWER." Rectangular manhole covers shall conform to the dimensions as shown on the plans. The bearing surfaces of frames and covers shall be machined, and the cover shall seat firmly into the frame without rocking or sliding. Gray iron castings shall be true to pattern in form, dimensions and thickness; shall be free of surface defects; and shall be free from visible, x-ray, and machine operation defects which would affect the service value of the castings. Castings shall be matched sets in appearance and sized as shown on the plans.

Assist access cover.--

The assist access cover shall be H-20 rated, single leaf, hinged with heavy duty pneumatic and/or spring assist for end user lifting force of 11 kg.

The cover and frame shall be constructed of aluminum.

Material shall be 6061-T6 aluminum for bars, angle and extrusions. A minimum 6 mm diamond plate shall be 5086 aluminum.

The cover shall be equipped with an aluminum hold open arm. Door shall lock open in the 90 degree position. The hold open arm shall be fastened to the frame with a 13 mm ANSI 316 stainless steel bolt.

Hinges shall be heavy duty design. Material shall be a brass alloy with a 448 MPa tensile strength. Each hinge shall have a 10 mm ANSI 316 stainless steel pin. Hinges shall be bolted to the angle frame and diamond plate with 316 stainless steel bolts and Ny-Lock nuts.

Aluminum shall be mill finish. Exterior of frame shall have a minimum of one coat of bituminous paint.

Each cover shall be supplied with a stainless steel Lev-L-Lock. The Lev-L-Lock shall be fastened with ANSI 316 stainless steel bolts and washers.

Each cover shall be equipped with a stainless steel lift handle. Lift handles shall be flush with top of diamond plate.

The number of leaves and the cover and frame size shall be as shown on plans.

CLEANOUTS.--

Cleanout to grade.--

Cleanout piping shall terminate with an appropriately sized flexible PVC access cap and stainless steel band coupler with hex tightening screw. Rubber coupling or cap will not be allowed. Access cap shall be Indiana Seal; Fernco; or equal.

Force main cleanout to grade.--

Force main cleanouts shall be PVC pressure pipe and fittings, Schedule 40, conforming to ASTM Designation: 1785. Pipe shall have plain ends with solvent welded fittings conforming to ASTM Designation: D2441.

MISCELLANEOUS MATERIALS.--

Cement mortar.--

Cement mortar shall be one part cement to 2 to 3 parts clean plaster or concrete sand mixed with just enough water for suitable consistency.

Epoxy mortar.--

Epoxy mortar shall be a commercial quality, trowelable, 3-component epoxy mortar consisting of 2 pourable epoxy components and a chemically resistant aggregate filler of silica quartz sand with a maximum water absorption of 0.1 percent. Epoxy shall have a pull-off strength of not less than 6.9 MPa and a 90 percent cure in 24 hours. Epoxy mortar shall be the type that requires no primer as a bonding agent.

Water hose.--

Water hose shall be 18 mm diameter x 30 m length commercial duty rubber hose, industrial 2-layer tire cord reinforcing, resistant to oil, chemicals, abrasion, and weather, with heavy duty brass couplings and octagon head for wrench or hand use.

Water nozzle.--

Water nozzle shall be straight nozzle, solid brass with barrel that moves freely from full open to full closed. Barrel shall be removable for use as full flow plain hose nozzle.

Grate.--

Grate shall be traffic rated. Grate shall be constructed of fiberglass reinforced thermoset plastic produced in a one-piece mold. Color shall be green or light gray and come with an anti-slip surface. Grate length shall not exceed 1.22 meters. Grate frame shall be supplied by the grate manufacturer. Frame and grate shall be CSI, Strongwell, or equal.

PART 3.- EXECUTION

INSTALLATION OF IDENTIFICATION.--

General.--Continuous underground tracer tape shall be installed directly above buried line and 150 mm to 300 mm below finished grade during backfilling operations.

INSTALLATION OF PIPES AND FITTINGS.--

General.--Pipe shall be installed upgrade unless otherwise permitted by the Engineer.

Sewers near water lines.--Sewers near water lines shall be installed below water lines in the same trench, in parallel trenches less than 3 meters apart, or at any crossing.

When water lines cross above a sewer line, a vertical separation of not less than 300 mm shall be maintained between the top of the sewer pipe and the bottom of the water line.

Cleaning pipe.--Interior of pipes shall be cleaned of dirt and other materials as the work progresses.

Lines between manholes shall be flushed as necessary to remove collected material.

Joint adapters.--Joints between different types of pipes shall be made with standard manufactured adapters and fittings intended for that purpose.

INSTALLATION OF METER BOXES.--

General.--Meter boxes shall be installed in accordance with the manufacturer's recommendations.

INSTALLATION OF CLEANOUTS.--

General.--Cleanouts shall be installed 90 degrees to finished grade and shall terminate in a meter box. A concrete pad, 450 mm long and 100 mm thick, shall be provided full width of the trench under a wye branch. A concrete collar shall be formed and cast-in-place around each cleanout valve box.

Cleanouts to grade shall be a combination of fittings as shown on the plans. Piping and fittings for NPS 4 pipe shall be sewer pipe and for NPS 3 and smaller shall be drain pipe.

Collars shall be broom surface finished. Collars shall match existing/finished grade. Compaction prior to form work shall be as specified elsewhere in these special provisions.

Where cleanouts are to be installed to grade in areas to be paved or surfaced, no individual structure shall be constructed to final grade until the paving or surfacing has been completed in the indicated area.

TAP CONNECTION.--

General.--Connections to existing systems shall be as shown on the plans and subject to approval by the local agency.

FIELD QUALITY CONTROL.--

Testing pipes.--All sewer and drain pipes shall be tested for obstructions before covering the pipes by balling and flushing the pipes with an approved commercial sewer cleaning ball. The ball shall be moved slowly through the sewer with a tag line. NPS 4 sewer pipe shall be tested by pulling an appropriate sized inflatable plug through the pipe. Obstructions or irregularities shall be removed or repaired.

Sewer and drain pipes shall be tested for leakage for a minimum period of 4 hours by filling with water to an elevation of 1.2 meters above the average invert of sewer, or to the top of the manholes where less than 1.2 meters deep. The system shall show no visible leaks, and the leakage rate shall not exceed the rate allowed by the local agency. In the absence of such requirements, leakage shall not exceed 0.5 liters per 24 hours, per millimeter diameter, per 30 meters of pipe. Sewers may be tested in sections with the test water progressively passed down the sewers if feasible. Water shall be released at a rate which will not create water hammer or surge in the plugged section of sewer.

In lieu of hydrostatic test with water, the air test method, as outlined in the Uniform Plumbing Code (UPC), "Low Pressure Air Test for Building Sewers," may be used.

Force main sewer pipe shall be tested in accordance with the requirements specified under "Pipe, Fittings and Valves," in Section 12-15, "Mechanical" of these special provisions

12-2.10 SEWAGE PUMPING STATION ENCLOSURE

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and constructing a sewage pumping station enclosure in accordance with the details shown on the plans and these special provisions.

Sewage pumping station enclosure shall consist of precast concrete manhole base and riser , cast-in-place concrete top slab and electrical panel pad, access door, vent pipe, ground rod and other work as necessary for a complete installation.

Earthwork, including excavation and backfill, shall conform to the requirements in "Earthwork for Building Work," in this Section 12-2.

Pervious backfill material shall conform to the requirements in "Free Draining Granular Material," in this Section 12-2.

Cast-in-place concrete shall conform to the requirements for structural work in "Cast-In-Place Concrete" in Section 12-3, "Concrete and Reinforcement" in these special provisions.

Bar reinforcing steel shall conform to the requirements in "Cast-In-Place Concrete," in Section 12-3, "Concrete and Reinforcement" in these special provisions.

Pumping station equipment shall conform to the requirements in "Sewage Pumping Station Equipment," in Section 12-11, "Equipment," of these special provisions.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data for access door and precast manhole base and riser sections shall be submitted for approval.

QUALITY ASSURANCE.--

Certificates of Compliance.--Certificates of Compliance shall be furnished for precast manhole base and risers in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

PART 2.- PRODUCTS

MANUFACTURED UNITS.--

Precast manhole riser sections.--

Precast reinforced concrete manholes shall be not less than 1.8 meters in diameter and conform to the requirements in ASTM Designation: C 478M.

Precast manhole base section.--

Precast manhole base section shall be integral with sidewalls.

MATERIALS.--

Waterproofing membrane.--

Waterproofing membrane shall be a liquid, cold applied, seamless, single component, bitumen modified polyurethane formulated for airless spraying surfaces.

A wet mil thickness gage shall be supplied by the Contractor for use by the Engineer.

Properties of the cured material shall be as follows:

Property	Value	Test Designation
Wet film thickness	2.5 mm min.	Wet film thickness gage
Shore A hardness	10 min.	ASTM D 2240
Elongation, %	350 min.	ASTM D 412
Tensile strength (kPa)	550 min.	ASTM D 412
Application rate, approximate	3 liters per square meter	Inspection, wet mil thickness

Waterproofing membrane shall be Rexnord Chemical Products, HLM 500; Polycoat Products, Aquaseal; Select Products Company, Select Poly-Kote LM; or equal.

Epoxy mortar.--

Epoxy mortar shall be a commercial quality, trowelable, 3-component epoxy mortar consisting of 2 pourable epoxy components and a chemically resistant aggregate filler of silica quartz sand with a maximum water absorption of 0.1 percent. Epoxy shall have a pull-off strength of not less than 6900 kPa and a 90 percent cure in 24 hours. Epoxy mortar shall be the type that requires no primer as a bonding agent.

ACCESSORIES.--

Access door.--

Access door shall be single or double leaf, 6 mm minimum extruded aluminum frame with built-in neoprene cushion and strap anchors suitable for installation in concrete. Door or doors shall be aluminum diamond plate reinforced with aluminum stiffeners as required. Steel hinges shall be bolted to underside and pivot on tension bars for easy opening. Cover to withstand a load of not less than 7182 Pa, open to 90 degrees and lock open in that position, and equipped with snap lock and removable handle. Door hardware shall be corrosion resistant. Aluminum shall be mill finish and bituminous coating shall be applied to exterior of frame by manufacturer.

The clear door opening shall conform to the requirements of the equipment manufacturer to permit installation and removal of the pumping station equipment.

Access door shall be Babcock-Davis Hatchways, Inc., Type FB; Bilco Co., Type K or KD; or equal.

Vent pipe.--

Vent pipe shall be commercial quality galvanized steel pipe and fittings.

PART 3.- EXECUTION

INSTALLATION.--

Precast manhole base and risers.--Ends of riser sections shall be thoroughly cleaned and wetted prior to placing epoxy mortar.

Joint in lower section shall be completely filled with mortar prior to setting next section in place. Interior surfaces of joints shall be trowelled smooth.

All joints and penetrations of manholes shall be sealed watertight with epoxy mortar.

Application of coating.--The interior surfaces of the enclosure shall be prepared and coated with waterproofing membrane in accordance with the manufacturer's recommendations.

FIELD QUALITY CONTROL.--

Testing.--When, in the opinion of the Engineer, the groundwater table is too low to permit visual detection of leaks, pumping station enclosure shall be hydrostatically tested.

Inlets and outlets shall be plugged and the enclosure filled to the height determined by the Engineer.

Enclosure may be filled 24 hours prior to testing to permit normal absorption into the walls to take place.

Leakage in the enclosure shall not exceed 1.25 liters per hour per meter of head above the invert.

Enclosures that do not meet the hydrostatic test shall be repaired or replaced.

12-2.11 SANITARY STATION

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing a sanitary station in accordance with the details shown on the plans and these special provisions.

Concrete and reinforcement shall conform to the requirements for minor work specified under "Cast-In-Place Concrete" in Section 12-3, "Concrete and Reinforcement" of these special provisions.

SUBMITTALS.--

PART 2.- PRODUCTS

Sewer and vent pipe below finished grade.--

Sewer and vent pipe below finished grade shall be polyvinyl chloride (PVC) plastic sewer pipe and fittings, Standard Dimension Ratio (SDR) 35, conforming to ASTM Designation: D 3034 or PVC drain waste and vent pipe (PVC-DWV) and fittings conforming to ASTM Designation: D 2665.

Vent pipe above finished grade.--

Vent pipe above finished grade and embedded in concrete foundation shall be Schedule 40 galvanized steel pipe with galvanized malleable iron fittings.

Signs.--

Signs shall be galvanized sheet steel not less than 1.6 mm thick (16-gage) with baked enamel finish and galvanized steel mounting plate and fastening hardware. Sign colors and messages shall be as shown on the plans.

PART 3.- EXECUTION

INSTALLATION.--

Sewer and vent piping.--The sewer and vent piping shall be installed in accordance with the applicable requirements specified under "Sanitary Sewage Disposal System," in this Section 12-2 of these special provisions.

Warning signs.--Warning signs and instructional signs for use of the sanitary station shall be installed in accordance with the details shown on the plans.

12-2.12 GUARD POSTS

PART 1.- GENERAL

Scope.--This work shall consist of constructing guard posts in accordance with the details shown on the plans and these special provisions.

PART 2.- PRODUCTS

Steel posts.--

Steel posts for guard posts shall be standard weight, galvanized steel pipe conforming to the details shown on the plans.

Concrete.--

Concrete for guard posts shall be commercial quality concrete, proportioned to provide a workable mix suitable for the intended use, with not less than 300 kilograms of cement per cubic meter.

PART 3.- EXECUTION

Installation.--The length and diameter of the guard posts shall conform to the details shown on the plans.

Guard posts shall be placed in holes excavated to the depth and cross section shown on the plans, and shall be installed plumb.

Guard posts shall be backfilled with concrete as shown on the plans.

Painting.--Guard posts shall be prepared and painted in accordance with the requirements specified under "Painting" in Section 12-9, "Finishes" of these special provisions.

12-2.13 PARKING BUMPERS

PART 1.- GENERAL

Scope.--This work shall consist of furnishing and installing precast concrete parking bumpers in accordance with the details shown on the plans and these special provisions.

PART 2.- PRODUCTS

Parking bumpers.--

Parking bumpers shall be commercially available precast parking bumpers.

Parking bumpers shall be 1220 mm long, nominal 200 mm wide and 150 mm high with both top longitudinal corners continuously chamfered, and anchor holes 230 mm from each end.

PART 3.- EXECUTION

Layout.--Arrangement of parking bumpers shall be coordinated with the layout of parking stalls and traffic aisles, providing the proper angle to engage wheels and proper location to prevent overtravel of vehicles.

Parking bumpers shall be anchored with two 19 mm diameter reinforcing bars 380 mm in length. The reinforcing bars shall be installed such that the top of the bars is flush with the top of the parking bumper.

12-2.14 ACCESSIBLE PARKING AND AUTHORIZATION SIGNS

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing accessible parking and authorization signs in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data and sign fastening details shall be submitted for approval.

PART 2.- PRODUCTS

Accessible parking stall identification sign.--

Accessible parking stall identification sign shall be a metal sign with baked enamel finish and the international symbol of accessibility. Sign background shall be blue and shall conform to Federal Standard 595B, Color No. 15090. Symbol, lettering and border shall be white and shall conform to Federal Standard 595B, Color No. 17886.

Van accessible sign.--

Van accessible sign shall be a metal sign with baked enamel finish and the international symbol of accessibility. Sign background shall be blue and shall conform to Federal Standard 595B, Color No. 15090. Lettering and border shall be white and shall conform to Federal Standard 595B, Color No. 17886.

Unauthorized vehicles parking sign.--

Unauthorized vehicles parking sign shall be a metal sign with baked enamel finish. Sign background shall be blue and shall conform to Federal Standard 595B, Color No. 15090. Lettering and border shall be white and shall conform to Federal Standard 595B, Color No. 17886. Lettering shall be not less than 25 mm in height and shall read as shown on the plans.

Support post.--

Support post shall be commercial quality, standard weight, galvanized steel pipe. Pipe diameter shall be 35 mm.

Fastening hardware.--

Fastening hardware shall be galvanized or cadmium plated.

Concrete.--

Concrete for support posts shall be commercial quality concrete, proportioned to provide a workable mix suitable for the intended use, with not less than 300 kilograms of cement per cubic meter.

PART 3.- EXECUTION

Installation.--Support posts shall be placed in holes excavated to the depth and cross-section shown on the plans. Posts shall be set vertical and shall be firmly embedded in concrete backfill. The top of the concrete backfill around the post shall be crowned to drain water.

Support posts shall be fitted with a rainproof top.

Sign shall be fastened rigidly and securely to the support post.

The Engineer will provide the Contractor with the necessary information for the disabled authorization sign.

SECTION 12-3. CONCRETE AND REINFORCEMENT

12-3.01 CAST-IN-PLACE CONCRETE

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of constructing cast-in-place concrete facilities in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data for admixtures, expansion joint material, vapor barrier, hardener, and sealer shall be submitted for approval.

Descriptive data shall be delivered to the Engineer at the jobsite.

QUALITY ASSURANCE.--

Certificates of Compliance.--Certificates of Compliance shall be furnished for cement, reinforcement, admixtures, and freeze-thaw aggregates in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

PART 2.- PRODUCTS

CONCRETE MIXES.--

Concrete (structural work).--

Commercial quality concrete shall be proportioned to provide a workable mix suitable for the intended use; shall have not less than 350 kg/m^3 of cement; 0 to 50 mm penetration, inclusive, as determined by California Test 533.

The air content of the freshly mixed concrete shall be 6 ± 1 1/2 percent, as determined by California Test 504.

Concrete (minor work).--

Commercial quality concrete for thrust blocks and collars shall be proportioned to provide a workable mix suitable for the intended use; shall have not less than 300 kg/m^3 of cement; 0 to 50 mm penetration, inclusive, as determined by California Test 533.

The air content of the freshly mixed concrete shall be 6 ± 1 1/2 percent, as determined by California Test 504.

Concrete (sewer structures and washrack).--

Commercial quality concrete for sewer structures, vehicle washrack slab, shall be proportioned to provide a workable mix suitable for the intended use; shall have not less than 400 kg/m^3 of a mixture of Type II cement and 15 percent by weight of a mineral admixture or Type IP (MS) Modified cement; 0 to 50 mm penetration, inclusive, as determined by California Test 533.

The air content of the freshly mixed concrete shall be 6 ± 1 1/2 percent, as determined by California Test 504.

CONCRETE MATERIALS.--

Cement.--

Cement shall conform to ASTM Designation: C 150, Types II, or III portland cement; or Type IP (MS) Modified cement. Type IP (MS) Modified shall conform to ASTM Designation: C 595 and shall be comprised of an intimate mixture of Type II Modified cement and not more than 20 percent of a pozzolanic material.

Aggregates.--

Aggregates shall be free from deleterious coatings, clay balls and other extraneous materials.

Aggregates proposed for use shall conform to the requirements for freezing and thawing shall as determined by California Test 528.

A list of sources of aggregates which have previously passed the freeze-thaw test is available in the District Office at 1657 Riverside Drive, Redding, CA 96001

Admixtures.--

Admixtures used in portland cement concrete shall be included on the Department's current list of approved admixtures, and shall conform to ASTM Designation: C 494, Types A, B, D, F or G for chemical admixtures; ASTM Designation: C 260 for air-entraining admixtures; and ASTM Designation: C 618 for mineral admixtures, except loss on ignition shall not exceed 4 percent. Properties of admixtures shall be uniform in each lot.

FORM MATERIALS.--

Forms for exposed finish concrete.--

Forms for exposed surfaces shall be plywood, metal or other panel type materials. Plywood shall be not less than 16 mm thick and without scars, dents, and delaminations. Forms shall be furnished in largest practical pieces to minimize number of joints.

Plywood shall conform to the requirements of U. S. Product Standard PS-1 for Exterior B-B (Concrete Form) Class I.

Forms for edges of slabs shall be nominal 50 mm solid stock lumber, plywood, or metal forms.

Forms for unexposed finish concrete.--

Forms for unexposed finish concrete surfaces shall be plywood, lumber, metal or other acceptable material.

Forms for cylindrical columns or supports.--

Forms for cylindrical columns shall be metal, fiberglass reinforced plastic, paper or fiber tubes. Paper or fiber tubes shall be constructed of laminated plies using water-resistant adhesive with wax-impregnated exterior for protection against weather or moisture.

Form ties.--

Form ties shall be factory fabricated, removable or snapoff metal ties for use as necessary to prevent spreading of forms during concrete placement.

Form oil.--

Form oil shall be commercial quality form oil which will permit the ready release of the forms and will not discolor the concrete.

REINFORCING MATERIALS.--

Bar reinforcement.--

Bar reinforcement shall conform to ASTM Designation: A 615/A 615M, Grade 60 [420], or ASTM Designation: A 706/A 706M.

Bar supports.--

Bar supports for reinforcement shall be precast mortar blocks or ferrous metal chairs, spacers, metal hangers, supporting wires, and other approved devices of sufficient strength to resist crushing under applied loads.

RELATED MATERIALS.--

Anchor bolts, nuts, and washers.--

Nonheaded anchor bolts shall conform to ASTM Designation: A 36/A 36M, with a minimum hook length of 6.2 diameters.

Headed anchor bolts shall conform to ASTM Designation: A 307.

Nuts shall conform to ASTM Designation: A 563M, Grade A.

Threaded rods shall conform to ASTM Designation: A 572.

Washers for anchor bolts shall be commercial quality.

Exposed anchor bolts, nuts, and washers shall be hot-dipped galvanized.

Expansion joint material.--

Expansion joint material shall be commercial quality asphalt impregnated pressed fiber sheets, 13 mm minimum thickness.

Vapor barrier.--

Vapor barrier shall be commercial quality polyethylene sheets not less than 0.15 mm thick.

Type A control joints.--

Type A control joints shall be commercial quality, preformed, T-shaped plastic strips with detachable top flange.

Keyed construction joint forms.--

Keyed construction joint forms shall be commercial quality, galvanized metal or plastic, factory fabricated construction joint forms. Forms shall produce a rabbeted key type joint.

Mortar.--

Mortar shall consist of one part cement to 2 parts clean sand and only enough water to permit placing and packing.

Curing compound.--

Curing compound shall be a non-pigmented curing compound with fugitive dye conforming to the requirements of ASTM Designation: C 309, Type 1-D, Class A.

Concrete hardener.--

Concrete hardener shall be commercial quality water borne penetrating type magnesium fluosilicate, zinc fluosilicate or combination thereof.

Concrete sealer.--

Concrete sealer shall be commercial quality VOC-compliant, silane type sealer with hydrophobic and oleophobic properties. Concrete sealer shall be ProSoCo, Inc., Standoff Tile and Masonry Protector (TMP); Tamms Industries, Hey'Di H.O.S.; Textured Coatings of America, Inc., Rainstopper 1750W-Clear; or equal.

ADMIXTURES.--

General.--Admixtures shall be used when specified or ordered by the Engineer and may be used at the Contractor's option to conserve cement or to facilitate any construction operation.

Calcium chloride shall not be used in any concrete.

Admixtures shall be combined with concrete materials by methods that produce uniform properties throughout the concrete.

If more than one admixture is used, said admixtures shall be compatible with each other so that the desirable effects of all admixtures will be realized.

Mineral admixtures may be used to replace up to 15 percent of Type II portland cement provided the weight of mineral admixture used is not less than the weight of cement replaced. Mineral admixtures shall not be used to replace Type IP (MS) Modified or Type III cements. Chemical admixtures may be used to reduce up to 5 percent of the portland cement except that the cement content shall not be less than 300 kg/m^3. When both chemical and mineral admixtures are used with Type II cement, the weight of cement replaced by mineral admixture may be considered as cement in determining the resulting cement content.

Mineral admixtures will be required in the manufacture of concrete containing aggregates that are determined to be "deleterious" or "potentially deleterious" when tested in accordance with ASTM Designation: C 289. The use of mineral admixture in such concrete shall conform to the requirements in this section except that the use of set retarding admixtures will not be permitted.

When the use of a chemical admixture is specified or is ordered by the Engineer, the admixture shall be used at the rate specified or ordered. If no rate is specified or ordered, or if the Contractor uses a chemical admixture for his own convenience, the admixture shall be used at the dosage normally recommended by the admixture manufacturer.

When air-entrainment is specified or is ordered by the Engineer, the air-entraining admixture shall be used in amounts to produce concrete having the specified or ordered air content as determined by California Test 504. If the Contractor uses air-entrainment for his own convenience, the average air content shall not exceed 4 percent and no single test shall exceed 5 1/2 percent.

Chemical admixtures and air-entraining admixtures shall be dispensed in liquid form. Dispensers shall have sufficient capacity to measure at one time the total quantity required for each batch. If more than one liquid admixture is used in the concrete, a separate measuring unit shall be provided for each liquid admixture and dispensing shall be such that the admixtures are not mixed at high concentrations. When air-entraining admixtures are used with other liquid admixtures, the air-entraining admixtures shall be the first to be incorporated into the mix. Unless liquid admixtures are added to premeasured water for the batch, they shall be discharged to flow into the stream of water so that the admixtures are well dispersed throughout the batch.

BAR REINFORCING STEEL.--

Bending.--Reinforcing steel bars shall accurately conform to the dimensions shown on the plans.

Bars shall be bent or straightened in a manner that will not crack or break the material. Bars with kinks or improper bends shall not be used.

Hooks, bends and splices shall conform to the provisions of the Building Code Requirements for Reinforced Concrete of the American Concrete Institute.

MIXING AND TRANSPORTING CONCRETE.--

General.--When a truck mixer or agitator is used for transporting concrete to the delivery point, discharge shall be complete within 1 1/2 hours, or before 250 revolutions of the drum or blades, whichever comes first, after the introduction of cement to the aggregates.

Truck mixers or agitator shall be equipped with electrically or mechanically actuated revolution counters by which the number of revolutions of the drum or blades may readily be verified. The counters shall be of the continuous-registering type, which accurately register the number of revolutions and shall be mounted on the truck so that the Engineer may safely and conveniently inspect them from alongside the truck. Under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 30°C or above, a time less than 1 1/2 hours may be required.

When non-agitating hauling equipment is used for transporting concrete to the delivery point, discharge shall be complete within one hour after the introduction of cement to the aggregates. Under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 30°C, or above, the time between the introduction of cement to the aggregates and discharge shall not exceed 45 minutes.

Each load of concrete for the work shall be accompanied by a trip ticket, a copy of which shall be delivered to the Engineer at the jobsite. The trip ticket shall show volume of concrete, weight of cement and aggregates, quantity of each admixture, quantity of water including water added at the jobsite, time of day the concrete is batched, and revolution counter readings on transit mix trucks at the times the truck is charged and unloaded.

PART 3.- EXECUTION

PREPARATION.--

Existing concrete construction.--Where fresh concrete joins existing or previously placed concrete or masonry, the contact surfaces of the existing or previously placed material shall be roughened, cleaned, flushed with water and allowed to dry to a surface dry condition immediately prior to placing the fresh concrete. The roughened surface shall be no smoother than a wood trowelled surface. Cleaning of the contact surfaces shall remove laitance, curing compounds, debris, dirt and such other substances or materials which would prevent bonding of the fresh concrete.

Abrasive blast methods shall be used to clean horizontal construction joints to the extent that clean aggregate is exposed.

Exposed reinforcing steel located at the contact surfaces which is to be encased in the fresh concrete shall be cleaned to remove any substance or material that would prevent bonding of the fresh concrete.

Forms.--Forms shall be mortar tight, true to the dimensions, lines, and grades shown on the plans, securely fastened and supported, and of adequate rigidity to prevent distortion during placing of concrete.

Forms for exposed surfaces shall be constructed with triangular fillets not less than 19 mm x 19 mm attached so as to prevent mortar runs and to produce smooth straight chamfers at all sharp edges of the concrete.

Form fasteners shall be removable without chipping, spalling, heating or otherwise damaging the concrete surface. Form ties shall be removed to a depth of at least 25 mm below the surface of the concrete.

The inside surfaces of forms shall be cleaned of all dirt, mortar and foreign material. Forms shall be thoroughly coated with form oil prior to use.

Forms shall not be stripped until at least 40 hours after placing concrete.

Anchorages and embedded items shall be placed and rigidly secured at their planned locations prior to placing concrete.

Reglets or embedded flashing shall be installed on concrete forms before the concrete is placed.

Vapor barrier.--Vapor barrier shall be lapped 150 mm and securely taped at splices. Vapor barrier shall be protected with a 75 mm layer of clean uncompacted sand cover.

Unless otherwise shown on the plans, vapor barrier shall be placed under portions of the floor slab scheduled to receive finish flooring.

Placing reinforcing steel.--Reinforcing steel bars shall be accurately placed to the dimensions shown on the plans.

Bar reinforcement conforming to ASTM Designation: A 615/A 615M, Grade 60 [420], or A 706//A 706M shall be lapped at least 45 diameters.

Bars shall be firmly and securely held in position by means of wiring and approved bar supports. The spacing of supports and ties shall prevent displacement of the reinforcing or crushing of supports.

Tie wire shall be clear of concrete formwork and concrete surfaces.

All reinforcing steel shall be in place and inspected before concrete placement begins. Placing of bars on fresh layers of concrete will not be permitted.

Ground bar.--A continuous reinforcing steel bar shall be installed in the building foundation at the location indicated on the plans for the electrical ground bar. The use of epoxy coated reinforcing bar is not permitted. The end of the ground bar shall extend beyond the concrete surface and shall be protected from damage by construction operations.

Hydronic tubing.--Hydronic tubing shall be securely fastened to the bar reinforcing using nylon ties.

The hydronic heating system shall be fully tested prior to placing concrete.

PLACING CONCRETE.--

General.--Concrete shall be placed and consolidated by means of internal vibrators to form dense, homogeneous concrete free of voids and rock pockets.

Forms and subgrade shall be thoroughly moistened with water immediately before placing concrete.

Concrete shall be placed as nearly as possible to its final location and the use of vibrators for extensive shifting of the concrete will not be permitted.

Concrete shall be deposited and consolidated in a continuous operation within limits of construction joints, until the placing of the panel or section is completed.

When concrete is to be placed in large areas requiring more than two pours, concrete shall be placed in alternate long strips between construction joints and the final slab infilled.

FINISHING CONCRETE SURFACES.--

Finishing unformed surfaces.--Slabs shall be placed full thickness to finish elevation and leveled to screeds by use of long straightedges. The screeds shall be set to grade at approximately 1.8 meter centers. After leveling, screeds shall be removed and the surface shall be floated with wooden floats.

Type A control joint strips shall be inserted into the floated concrete so that the bottom of the top flange is flush with the finish elevation. Strips shall be standard manufactured lengths and shall be placed on an approximate straight line. The top flange of the strips shall be removed after the concrete has set and cured.

The floated surface shall be trowelled with steel trowels. Troweling shall form a dense, smooth and true finish. Walkways, pedestrian ramps, stairs and outdoor slabs for pedestrian traffic shall be given a non-slip broom finish unless a different finish is called for on the plans or in these special provisions.

The application of cement dust coat will not be permitted.

Concrete floor surfaces to receive ceramic tile shall be floated to grade and then, before final set of the concrete, the floated surfaces shall be roughened with stiff bristled brushes or rakes.

Finished surfaces of floor slabs shall not deviate more than 3 mm from the lower edge of a 3-meter long straight edge.

Finishing formed surfaces.--Formed concrete surfaces shall be finished by filling holes or depressions in the surface, repairing all rock pockets, and removing fins. All surfaces of formed concrete exposed to view shall have stains and discolorations removed, unsightly bulges removed, and all areas which do not exhibit the required smooth, even surface of uniform texture and appearance shall be sanded with power sanders or other approved abrasive means until smooth, even surfaces of uniform texture and appearance are obtained.

Cement mortar, patching and finishing materials used to finish exposed surfaces of concrete shall closely match the color of surrounding surfaces.

CURING CONCRETE.--

General.--Freshly placed concrete shall be protected from premature drying and excessive cold or hot temperatures.

Initial curing of floor slabs shall start as soon as free water has disappeared from the concrete surface. The concrete shall be kept continuously wet by application of water for not less than 7 days after the concrete has been placed.

Cotton mats, rugs, carpets, or sand blankets may be used as a curing medium to retain the moisture during the curing period. Curing materials that will stain or discolor concrete shall not be used on surfaces exposed to view.

Prior to placing the curing medium, the entire surface of the concrete shall be kept damp by applying water with a nozzle that so atomizes the flow that a mist and not a spray is formed, until the surface of the concrete is covered with the curing medium. At the expiration of the curing period, the concrete surfaces shall be cleared of all curing mediums.

Concrete surfaces, other than floor slabs, shall be kept moist for a period of at least 5 days by leaving the forms in place or by covering the exposed surfaces using moist rugs, cotton mats or other curing materials approved by the Engineer.

Concrete collars may be cured with a curing compound.

PROTECTING CONCRETE.--

General.--Concrete shall not be placed on frozen or frost covered surfaces.

Concrete shall be protected from damage due to rain, freezing or inclement weather, and shall be maintained at a temperature of not less than 4°C for 72 hours. When required by the Engineer, the Contractor shall provide a written outline of his proposed methods of protecting concrete.

Vehicles, equipment, or concentrated loads weighing more than 140 kg individually and material stockpiles weighing more than 240 kg/m^2 will not be permitted on the concrete within 10 calendar days after placing.

SPECIAL TREATMENTS.--

Concrete hardener.--Chemical concrete hardener shall be applied to the floor surfaces shown on the plans, prior to the application of concrete sealer. Surfaces shall be clean and dry before the application of hardener.

The solution shall be applied in accordance with the manufacturer's instructions.

After the hardener has dried, the surface shall be mopped with water to remove encrusted salts.

Concrete sealer.--Concrete sealer shall be applied to the concrete surfaces designated on the plans in accordance with the manufacturer's instructions for heavy duty use. The sealer shall be applied to dry concrete surfaces.

SECTION 12-4. MASONRY

12-4.01 CONCRETE MASONRY UNITS

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of constructing reinforced hollow concrete masonry units in accordance with the details shown on the plans and these special provisions.

Related work.--Water repellent coating shall be applied in accordance with the requirements specified under "Water Repellent Coating" in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

PERFORMANCE REQUIREMENTS.--

Unit Strength.--Provide masonry units that develop the following installed compressive strengths (f'm) at 28 days:

Based on net area f'm = 10.34 MPa

SUBMITTALS.--

Product data.--Manufacturer's descriptive data for each type of masonry unit, accessory, and other manufactured products shall be submitted for approval.

Samples.--Two samples 100 mm x 100 mm of masonry units of each color and architectural finish shall be submitted for approval.

QUALITY ASSURANCE.--

Masonry preconstruction testing service.--The Contractor shall employ and pay all costs for the services of a testing laboratory acceptable to the Engineer and experienced in performing preconstruction masonry tests. The testing laboratory shall comply with the requirements of ASTM Designation: E 329.

Preconstruction tests shall be performed on the following materials by the Unit Strength Method as defined by Section 2105, "Quality Assurance," of the Uniform Building Code:

Concrete masonry units shall be tested in accordance with ASTM Designation: C 140.

Grout shall be tested in accordance with ASTM Designation: C 1019.

In addition:

Mortar shall be tested in accordance with Uniform Building Code Standard: 21-16

Test results shall be reported in writing to the Engineer and the Contractor on the same day the tests are made.

Single source responsibility.--Exposed masonry units of uniform color and texture shall be obtained from one manufacturer for each different product required for each continuous surface or visually related surfaces.

Mortar ingredients of uniform quality, including color for exposed masonry, shall be obtained from one manufacturer for each cementitious component and from one source and producer for each aggregate.

Certificates of Compliance.--Certificate of Compliance shall be furnished for masonry units, aggregate for grout and transit mixed grout in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

DELIVERY, HANDLING AND STORAGE.--

Delivery.--Masonry materials shall be delivered to the project in an undamaged condition.

Storage and handling.--Masonry units shall be stored and handled in order to prevent deterioration or damage due to moisture, temperature changes, contamination, corrosion or other causes.

PART 2.- PRODUCTS

CONCRETE MASONRY UNITS.--

Concrete masonry units.--

Concrete masonry units shall be nominal size, color and architectural finish as shown on plans; hollow load bearing, light weight or medium weight, Grade N, Type II, conforming to ASTM Designation: C 90; standard or open ended masonry units.

Special shapes shall be provided where required for lintels, corners, jambs, sash, control joints, headers, bonding and other special conditions.

MORTAR AND GROUT MATERIALS.--

Cement.--

Cement for mortar shall be Type II, low alkali portland cement conforming to ASTM Designation: C 150; or masonry cement conforming to ASTM Designation: C 91.

Cement for grout shall be Type II portland cement conforming to ASTM Designation: C 150 with maximum 15 percent Class N, F, or C mineral admixture conforming to ASTM Designation: C 618 except that the loss on ignition shall not exceed 4 percent; or Type IP(MS) blended hydraulic cement conforming to ASTM Designation: C 595.

Aggregate.--

Aggregate for mortar shall conform to ASTM Designation: C 144, except not more than 10 percent shall pass the No. 100 sieve.

Aggregate for grout shall conform to ASTM Designation: C 404, except 100 percent of the coarse aggregate shall pass the 9.5 mm sieve. Soundness loss shall not exceed 10 percent as determined by California Test 214.

Coloring for mortar.--

Coloring for mortar shall be chemically inert, fade resistant mineral oxide or synthetic type.

Lime.--

Lime shall conform to ASTM Designation: C 207, Type S.

Premixed mortar or grout.--

A premixed packaged blend of cement, lime, and sand, with or without color, that requires only water to prepare for use as masonry mortar or grout may be furnished. Packages of premix shall bear the manufacturer's name, brand, contents, weight, and color identification.

Transit mixed grout.--

Transit mixed grout shall conform to ASTM Designation: C 94, except aggregate shall be as specified herein for aggregate for grout. The minimum compressive strength shall be 17236 kPa at 28 days when tested in accordance with ASTM Designation: C 39. Admixtures, if used, shall conform to ASTM Designation: C 494, Types A, E or F and shall not contain chlorides.

REINFORCEMENT, TIES AND ANCHORING DEVICES.--

Bar reinforcement.--

Bar reinforcement shall conform to ASTM Designation: A 615/A 615 M, Grade 60 [420], or ASTM Designation: A 706/A 706 M.

Anchor bolts.--

Anchor bolts shall conform to ASTM Designation: A 36/A 6M with a minimum hook length of 6.2 diameters, and shall be 12 mm diameter unless otherwise shown on the plans.

Anchors, ties, angles, and metal lath.--

Anchors, ties, angles, and metal lath shall be commercial quality, and shall be galvanized.

Dry pack.--

Dry pack to set items into masonry shall be one part portland cement to not over 3 parts of clean sand and with a minimum amount of water for hydration and packing.

PROPORTIONING MORTAR AND GROUT.--

General.--Mortar shall be proportioned by loose volume and shall have one part cement, one quarter part of hydrated lime and 2 1/4 to 3 parts aggregate. Mortar shall be tinted with coloring to match the masonry units.

Grout, except transit mixed and packaged premix grout, shall be proportioned by loose volume and shall have one part cement, not more than 1/10 part hydrated lime, 2 1/4 to 3 parts sand aggregate, and not more than 2 parts gravel aggregate.

Aggregate shall be measured in a damp loose condition.

Grout shall be mixed with sufficient water to produce a mix consistency suitable for pumping without segregation. Slump shall not exceed 229 mm.

PART 3.- EXECUTION

CONSTRUCTION.--

General.--Masonry units shall be laid in running bond, except as otherwise shown on the plans.

Surfaces of metal, glass, wood, completed masonry, and other such materials exposed to view shall be protected from spillage, splatters and other deposits of cementitious materials from masonry construction. All such deposits shall be removed without damage to the materials or exposed surfaces.

Construction will comply with Section 2104 Construction of the Uniform Building Code. Tolerances specified in Section 2104 shall be in affect unless otherwise shown on the plans.

Where fresh masonry joins concrete or masonry, the contact surfaces of existing material shall be roughened, cleaned and lightly wetted. The roughened surface shall be no smoother than a wood troweled surface. Cleaning shall remove laitance, curing compounds, debris, dirt and any substance which decreases bond to the fresh masonry.

Masonry shall not be erected when the ambient air temperature is below 5° C.

Surfaces of masonry erected when the ambient air temperature exceeds 38° C. shall be kept moist with water for a period of not less than 24 hours. Water shall be uniformly applied with a fog spray at the intervals required to keep the surfaces moist but not to exceed 3 hours unless otherwise approved by the Engineer.

All anchors, bolts, dowels, reglets and other miscellaneous items to be cast into the wall, shall be firmly secured in place before grout is poured.

Shoring for concrete masonry lintels shall remain in place a minimum of 15 days after the wall has been completed.

Laying masonry units.--Concrete masonry units shall be laid dry.

During laying of units all cells shall be kept dry in inclement weather by suitably covering incomplete walls. Wooden boards and planks shall not be used as covering materials. The covering shall extend down each side of masonry walls approximately 600 mm.

Chases shall be kept free from debris and mortar.

Bond beam units with an opening at each cross web shall be used at all horizontal reinforcing bars.

Where masonry unit cutting is necessary, all cuts shall be made with a masonry saw to neat and true lines. Blocks with excessive cracking or chipping of the finished surfaces exposed to view will not be acceptable.

Lintels.--Masonry lintels shall be as shown on the plans. Lintels shall be formed using U-shaped lintel units with reinforcing bars placed as shown on the plans. Formed-in-place lintels shall be temporarily supported.

Bar reinforcement.--Bar reinforcement shall be accurately positioned in the center of the cell and securely held in position with either wire ties or spacing devices near the ends of bars and at intervals not exceeding 192 bar diameters. Wire shall be 16-gage or heavier. Wooden, aluminum, or plastic spacing devices shall not be used. Tolerances for the placement of vertical reinforcement in walls and flexural elements shall be ± 12 mm. Tolerance for longitudinal reinforcement in walls shall be ±50 mm.

The minimum spacing for splices in vertical reinforcement for masonry walls shall be 1220 mm plus lap.

Bar reinforcement shall not be placed in the plane of mortar joints.

Mortar.--Mortar joints shall be approximately 9.5 mm wide. Units shall be laid with all head and bed joints filled solidly with mortar for the full width of masonry unit shell. Head joints shall be shoved tight. Exposed joints shall be concave, tooled smooth, unless otherwise shown on the plans.

Mortar that has been mixed more than one hour shall not be retempered.

Mortar placed in joints shall preserve the unobstructed vertical continuity of the concrete filling. Any overhanging mortar projecting more than 12 mm, or other obstruction or debris shall be removed from the inside of such cells.

GROUTING.--

General.--All cells shall be filled solidly with grout. All grout in the cells shall be consolidated at the time of placement by vibrating and reconsolidated after excess moisture has been absorbed but before plasticity is lost. Slicing with a trowel is not acceptable.

Masonry units may be placed full height of the masonry work before grouting, or they may be placed in increments for individual grout pours.

Cleanouts shall be provided for all grout pours over 1524 mm in height. Such cleanouts shall be provided in the bottom course at every cell containing vertical reinforcement. After cell inspection, the cleanouts shall be sealed before filling with grout.

Masonry units shall be placed full height of the grout pour. Grout shall be placed in a continuous pour in grout lifts not exceeding 1828 mm. The interruption between placing successive lifts of grout shall be not more than one hour.

Between grout pours, a horizontal construction joint shall be formed by stopping the grout a minimum of 38 mm below the top of the last course, except if the joint is at a bond beam, it shall be 12 mm below the top of the bond beam unit, or at the top of the wall.

CLEANING AND PROTECTING MASONRY.--

General.--Splashes, stains or spots on the faces of the masonry exposed to view shall be removed.

Completed masonry shall be protected from freezing for a period of at least 5 days.

FIELD QUALITY CONTROL.--

General.-- The Contractor shall employ, at his own expense, a special inspector and testing laboratory to perform structural tests and inspections of masonry to verify that the construction conforms to the Uniform Building Code in accordance with the requirements in Section 1701, "Special Inspections," and Section 2105, "Quality Assurance," of the Uniform Building Code. The contractor shall submit a written Field Quality Control Plan that identifies the inspector, the lab, and the procedures used. The Field Quality Control Plan shall conform to these specifications and the 1997 Uniform Building Code. The contractor's Field Quality Control Plan shall be submitted to the Engineer for approval. The Engineer shall have three weeks to approve the plan.

The Contractor shall designate in the Field Quality Control Plan a masonry Quality Control Manager (QCM). The QCM shall be responsible directly to the Contractor for the quality of masonry, including materials and workmanship, performed by the Contractor and all subcontractors.

The QCM shall be the sole individual responsible to the Contractor for submitting, receiving, and approving all correspondence, required submittals, and reports to and from the Engineer.

The QCM shall not be employed or compensated by any subcontractor, or by other persons or entities hired by subcontractors, who will provide other services or materials for the project. The QCM may be an employee of the Contractor.

Masonry special inspection personnel or testing firms to be used in the work shall not be employed or compensated by any subcontractor, or by other persons or entities hired by subcontractors, who will provide other services or materials for the project, except for the following conditions:

Special Inspector.--The special inspector shall be, as a minimum, an International Conference of Building Officials (ICBO) certified Special Masonry Inspector. The special masonry inspector shall perform the inspections required under Section 1701.5.7., "Structural masonry" of the Uniform Building Code. The special inspector shall prepare a "Daily Field Report" providing information regarding the specific operations witnessed, including placing of masonry units and bar reinforcing, grouting, fabrication of test specimens, and other observations of importance to the work. A "Daily Field Report" is required for each day that the Special Inspector is on the jobsite. A copy of these reports shall be delivered to the Engineer on the day following the preparation. The special inspector shall submit a final signed report to the Engineer and Contractor stating whether the work requiring special inspection was, to the best of the inspector's knowledge, in conformance with the approved plans, specifications, and the applicable workmanship provisions of these specifications and the Uniform Building Code.

Testing.-- The testing laboratory shall comply with the requirements of ASTM Designation: E 329. Test results shall be reported in writing to the Engineer and the Contractor on the same day the tests are made. Testing shall be done in accordance with Section 2105.3,"Compliance with f'm" of the UBC. The Contractor can establish f'm by either Sections 2105.3.2, 2105.3.3, or 2105.3.3. A set of tests shall be done for each 465 m^2 of wall area, but not less than one test per project. Tests shall be performed on the following materials by the Unit Test Method as defined:

Concrete masonry units shall be tested in accordance with ASTM Designation: C 140.
Grout shall be tested in accordance with ASTM Designation: C 1019.
In addition:

Mortar shall be tested in accordance with Uniform Building Code Standard: 21-16

Any work not meeting the requirements of section 2105 shall be redone and retested. Sampling, inspecting, reworking and retesting of material will be done at the contractor's expense.

SECTION 12-5. METALS

12-5.01 STRUCTURAL STEEL FOR BUILDINGS

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of fabricating, assembling, furnishing and erecting structural steel in accordance with the details shown on the plans and these special provisions.
Structural steel consists of:

Roof framing and columns, including connections for all structures

Source quality control.--Materials and fabrication procedures are subject to inspection and tests in mill, shop and field, conducted by the Engineer or a qualified inspection agency. The Contractor or fabricator shall provide access to the Engineer or testing agency to places where the structural steel work is being fabricated or produced so that the required inspection and testing can be accomplished. Such inspections and tests will not relieve the Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements. The testing agency may inspect the structural steel at the plant before shipment; however, the Engineer reserves the right, at any time before final acceptance to reject the material that does not conform to the contract requirements.

REFERENCES.--

General.--Structural steel shall be fabricated, assembled and erected in accordance with American Institute of Steel Construction (AISC), "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings."
Welding shall be in accordance with American Welding Society (AWS) D1.1, "Structural Welding Code - Steel."

SUBMITTALS.--

Product data.--Product data for items to be incorporated into the work, including structural steel, high strength bolts, nuts and washers and alternative connectors, shall be submitted for approval.

Working drawings.--Working drawings and calculations shall be submitted for approval.
Working drawings shall show any changes proposed in the work, details of connections and joints exposed to the weather, details for connections not dimensioned on the plans, the sequence of shop and field assembly and erection, welding sequences and procedures. If required, the location of butt welded splices on a layout drawing of the entire structure, and the location and details of any temporary supports that are to be used.
Calculations and working drawings for falsework to be used for the erection of structural steel shall be submitted for approval. The falsework shall be designed and constructed to provide the necessary rigidity and to support loads which will

be applied. Working drawings and design calculations shall be stamped and signed by an engineer who is registered as a Civil or Structural Engineer in the State of California. The expiration date of the registration shall be shown.

CLOSEOUT SUBMITTALS.--

Final drawings.--At the completion of each building on the contract, one set of reduced prints on 27 kg (minimum) bond paper, 280 mm x 432 mm in size, of the corrected original tracings of all approved drawings for each building shall be furnished to the Engineer. An index prepared specifically for the drawings for each building containing sheet numbers and titles shall be included on the first reduced print in the set for each building. Reduced prints for each building shall be arranged in the order of drawing numbers shown in the index.

The edge of the corrected original tracing image shall be clearly visible and visually parallel with the edges of the page. A clear, legible symbol shall be provided on the upper left side of each page to show the amount of reduction and a horizontal and vertical scale shall be provided on each reduced print to facilitate enlargement to original scale.

QUALITY ASSURANCE.--

Qualifications for welding.--A certified copy of qualification test record for welders shall be submitted to the Engineer at the jobsite. Descriptive data for equipment for field welding structural steel, including type and electric power requirements, shall be submitted for approval.

Certificates of Compliance.--Certificate of Compliance shall be furnished for structural steel products in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications. Certificate of Compliance shall include mill test certificates for each heat number used in the work.

DELIVERY, HANDLING AND STORAGE.--

Structural materials shall be loaded, transported, unloaded and stored so that it is kept clean and undamaged. Material shall be stored above ground on platforms, skids, or other supports. Covers and protection shall be provided to protect the materials from corrosion.

Anchorages and anchor bolts, which are to be embedded in concrete or masonry, shall be delivered in ample time to not delay the work.

PART 2.- PRODUCTS

MATERIALS.--

Steel bars, plates and shapes.--

Steel beams shall conform to ASTM Designation: A 572/A 572M, Grade 50 [345].

Steel bars, plates and angles shall conform to ASTM Designation: A 36/A 36M or A 572/A 572M, Grade 50 [345].

Steel tubing.--

Steel tubing shall conform to ASTM Designation: A 500, Grade B.

Stud connectors.--

Stud connectors shall conform to ASTM Designation: A 108, Grades 1018 through 1020, cold drawn, either semi- or fully killed.

Machine bolts, nuts and washers.--

Machine bolts and nuts shall conform to ASTM Designation: A 307.

Washers for machine bolts shall be commercial quality.

Inorganic zinc primer.--

Inorganic zinc primer shall be a waterborne inorganic zinc primer conforming to the requirements of AASHTO Designation: M 300-92 I, Type II. Inorganic zinc primer shall be listed on the qualified products list which may be obtained from the Transportation Laboratory, (916) 227-7000.

Mortar.--

Mortar shall consist of one part cement, measured by volume, to 2 parts clean sand and only enough water to permit placing and packing.

FABRICATION.--

Shop fabrication and assembly.--Workmanship and finish shall be equal to the best general practice in modern shops.

Cuts shall not deviate more than 2 mm from the intended line. Roughness, notches or gouges shall be removed.

Bearing stiffeners at points of loading shall be square with the web and shall have at least 75 percent of the stiffener in contact with the flanges.

Finished members shall be true to line, shall have square corners and smooth bends and shall be free from twists, kinks, warps, dents and open joints.

Exposed edges and ends of metal shall be dressed smooth, with no sharp edges and with corners slightly rounded.

Stud connectors.--Steel surfaces shall be prepared as recommended by the manufacturer of the stud connectors. Stud connectors shall be welded to the flanges of beams or girders as shown on the plans. Automatic end welding of headed stud connectors shall be in accordance with the manufacturer's instructions.

Connections.--Abutting surfaces at connections shall be clean.

Cutting and welding at the jobsite will not be allowed except as shown on the approved drawings or specifically approved by the Engineer.

Finished holes for bolts shall be cylindrical and perpendicular to the plane of the connection. Subpunched and subdrilled holes shall be 6 mm smaller in diameter than the diameter specified for the finished hole.

Bolted Connections.--Bolts for connecting steel to steel shall be machine bolts conforming to ASTM Designation: A 307.

Holes for other work.--Holes for securing other work to structural steel and passage of other work through steel framing members shall be as shown on the approved drawings.

Threaded nuts or specialty items for securing other work to steel members shall be as shown on the approved drawings.

Holes shall be cut, drilled or punched perpendicular to metal surfaces. Holes shall not be flame cut or enlarged by burning. Holes are to be drilled in bearing plates.

SHOP PAINTING.--

General.--Structural steel members, except those to receive sprayed-fireproofing, shall be painted. Color shall be as shown on the plans.

Surface preparation.--Surfaces of structural steel to be receive inorganic zinc primer shall be blast cleaned in accordance with Steel Structures Painting Council, SSPC-SP 10, "Near-White Blast Cleaning."

Bolted connections.--Contact surfaces of ungalvanized anchor bolt assemblies shall be blast cleaned and coated with waterborne inorganic zinc primer before assembly. The total thickness of primer on each surface shall be between 0.025 mm to 0.076 mm and may be applied in one application.

Painting.--Immediately after surface preparation, surfaces of structural steel shall receive an undercoat of waterborne inorganic zinc primer. Color shall essentially match Federal Standard 595B, No. 36373.

The manufacturer's published mixing and application instructions for inorganic zinc primer shall be followed.

PART 3.- EXECUTION

ERECTION AND ASSEMBLY.--

Field splices.--Field splices shall be made only at the locations shown on approved working drawings.

The parts shall be accurately assembled in their final position as shown on the plans and in true alignment with related and adjoining work before final fastening.

All parts shall be supported adequately and at locations to provide a vibration free, rigid, and secure installation.

Bolted connections.--The bolt head type and head location shall be consistent within a joint.

Nuts shall be on side of member least exposed to view.

Setting bases and bearing plates.--Concrete and masonry surfaces shall be cleaned and roughened to improve bond. Bottom of base and bearing plates shall be clean.

Base plates and bearing plates for structural members shall be set on wedges or other adjusting devices.

Anchor bolts shall be wrench tightened after supported members have been positioned and plumbed.

Mortar shall be solidly packed between bearing surfaces and base or bearing plates to ensure that no voids remain. Exposed surfaces shall be finished and allowed to cure.

FIELD PAINTING.--

Touch-up painting.--After erection, the Contractor shall clean field welds, bolted connections, and abraded areas of shop paint and apply the same materials as applied for shop painting.

Surfaces that are scheduled to receive finish coats shall be painted with an additional prime coat and finish coats in accordance with the requirements specified for shop primed steel under "Painting" in Section 12-9.

QUALITY CONTROL.--

Testing and inspection.--Ultrasonic examination shall be performed by the Contractor on at least 50 percent of all full penetration butt-welded splices in accordance with the requirements of AWS D1.1 and these special provisions.

Welding procedures and methods shall be subject to inspection for conformance with AWS D1.1.

Butt welds shall be tested in accordance with AWS D1.1, Chapter 6, Part C, Ultrasonic Testing of Groove Welds.

Examination, reporting and disposition of tests shall be in accordance with the provisions of 6.12, AWS D1.1.

In addition to ultrasonic examinations by the Contractor, welds may be subject to inspection or non-destructive testing by the Engineer.

When additional inspection or non-destructive testing is required by the Engineer, the Contractor shall provide sufficient access facilities in the shop and at the jobsite to permit the Engineer or his agent to perform such inspection and testing.

The Contractor shall correct all deficiencies in the structural steel work which inspections and laboratory test reports have indicated to be not in compliance with these special provisions. Additional tests shall be performed by the Contractor at his expense to reconfirm any non-compliance of original work, and to show compliance of the corrected work.

12-5.02 METAL DECKING

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing metal decking in accordance with the details shown on the plans and these special provisions.

Metal decking includes ribbed sheet steel decking units, bent plates, accessories, fasteners and such other components, not mentioned, but required for a rigid, secure and complete installation.

REFERENCES.--

General.--The design, fabrication and erection of metal decking shall conform to the applicable requirements of the American Iron and Steel Institute (AISI) publication, "Specifications for the Design of Light Gauge Cold Formed Steel Structural Members," and the applicable Steel Deck Institute Design Manual and these special provisions.

Welding shall be in accordance with American Welding Society (AWS) D1.3, "Structural Welding Code - Sheet Steel."

SUBMITTALS.--

Product data.--Manufacturer's descriptive data for each type of deck and accessories shall be submitted for approval.

Working drawings.--Working drawings showing complete erection layouts, details, dimensions, deck section properties shall be submitted for approval. Drawings shall show types and gages, fastening methods, including the location, type and sequence of connections, sump pans, cut openings, surface finishes and temporary supports or bracing.

The metal deck supplier shall submit a fastening schedule and calculations stamped by an engineer who is registered as a Civil or Structural Engineer in the State of California showing that the metal roof panels, clips, and fasteners conform to the span and design loads shown on the plans and the wind uplift requirements of the Uniform Building Code as amended by Title 24, Part 2, California Code of Regulations.

QUALITY ASSURANCE.--

Qualification of field welding.--Welding processes and welding operators shall be qualified in accordance with "Welder Qualification," procedures in American Welding Society (AWS) D1.1, "Structural Welding Code - Steel."

Welding decking in place is subject to inspection and testing. Defective work shall be removed and replaced with acceptable work.

Certificates of Compliance.--Certificates of Compliance shall be furnished for the metal decking in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

DELIVERY, HANDLING AND STORAGE.--

General.--Metal deck units and accessories shall be transported, stored and erected in a manner that will prevent corrosion, distortion or other damage.

Deck units shall be stored off the ground with one end elevated to provide drainage.

PART 2.- PRODUCTS

MANUFACTURERS.--Acceptable manufacturers shall be; Verco Manufacturing Co.; BHP Co.; or equal.

MATERIALS.--

Deck units.--

Deck units, closures and plates shall be fabricated from galvanized sheet steel conforming to ASTM Designation: A 653/A 653M, Grade shall be as shown on the plans.

Galvanizing shall conform to the requirements of ASTM Designation: A 924/A 924M, G60 [Z180].

Miscellaneous steel shapes.--

Miscellaneous steel shapes shall conform to ASTM Designation: A 36/A 36M.

Anchor clips, vent clips, flashing, saddle plates, flexible closure strips and other accessories.--

Anchor clips, vent clips, flashing, saddle plates, flexible closure strips and other accessories shall be as recommended by the decking manufacturer.

FABRICATION.--

General.--Deck units shall be formed to span 3 or more supports with flush, telescoped or nested 50 mm laps at ends and interlocking or nested side laps unless otherwise shown on the plans.

Deck units shall conform to the configurations, metal thickness, depth and width and section properties shown on the plans.

End bearing shall be not less than 38 mm.

Metal closure strips.--Metal closure strips for opening between deck units and other construction shall be fabricated from the same gage and material as the adjacent deck units. Strips shall be formed to provide tight-fitting closures at end of cells or flutes and sides of decking.

Cleaning.--When spray-on fireproofing is specified, the decking manufacturer shall supply decking free of amounts of oil or lubricants which would significantly impair the adhesion of the spray-on fireproofing.

PART 3.- EXECUTION

INSTALLATION.--

General.--Deck units and accessories shall be installed in accordance with the manufacturer's recommendations and approved drawings and these special provisions.

Units shall be placed on supporting steel framework, adjusted in place and properly aligned before being permanently fastened. Ends of units shall have positive bearing over structural supports.

Cutting and fitting shall present a neat and true appearance with exposed burrs removed. Openings through the decking shall be cut square and shall be reinforced as recommended by the decking manufacturer.

The metal deck shall not be used as a working platform before deck units are fastened in place. Supplies, equipment or other loads shall not be stored on the deck. Mechanical equipment or other loads shall not be hung from metal roof decking.

Welding.--Welding shall conform to AWS requirements (D1.1 and D1.3) and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.

Welding washers shall be used where recommended by the manufacturer.

Fastening roof deck units.--Roof deck units shall be fastened to supporting steel members as shown on the structural plans.

Fastening side laps.--Side laps of adjacent deck units shall be fastened as shown on the plans.

Field painting:--Metal decking shall be shop primed and field painted. Locations of decking to be field painted shall be as shown on the plans.

Galvanized surfaces shall be touched-up with galvanizing repair paint recommended by the manufacturer.

12-5.03 BUILDING MISCELLANEOUS METAL

PART 1.- GENERAL

Scope.--This work shall consist of fabricating, furnishing and installing building miscellaneous metal in accordance with the details shown on the plans and these special provisions.

Building miscellaneous metal shall consist of the following:

Evaporative cooler and unit heater support
Sectional overhead door jambs, header and track supports
Rafter supports
Miscellaneous plates and shapes

including all anchors, fastenings, hardware, accessories and other supplementary parts necessary to complete the work.

REFERENCES.--

Codes and standards.--Welding of steel shall be in accordance with American Welding Society (AWS) D 1.1, "Structural Welding Code-Steel" and D 1.3, "Structural Welding Code-Sheet Steel."

SUBMITTALS.--

Product data.--Submit manufacturer's specifications, anchor details and installation instructions for products used in miscellaneous metal fabrications.

Working drawings.--Working drawings of fabricated items shall be submitted for approval.

QUALITY ASSURANCE.--

Shop assembly.--Preassemble items in shop to the greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark all units for reassembly and installation.

Inspection and tests.--Materials and fabrication procedures shall be subject to inspection and tests by the Engineer, in mill, shop and field. Such tests will not relieve the Contractor of responsibility of providing materials and fabrication procedures in compliance with specified requirements.

PART 2.- PRODUCTS

MATERIALS.--

Steel bars, plates and hot-rolled shapes.--

Steel bars, plates and hot-rolled shapes shall conform to ASTM Designation: A 36/A 36M.

Bolts, studs, threaded rods, nuts and washers.--

Bolts, studs, threaded rods, and nuts for general application shall conform to ASTM Designation: A 307.
Washers shall be commercial quality.

Expansion anchors.--

Expansion anchors shall be ICBO approved for the purpose intended, integral stud type anchor or internally threaded type with independent stud, hex nut and washer.

Powder driven anchors.--

Powder driven anchors shall be plated, spring steel alloy drive pin or threaded stud type anchors for use in concrete or steel. Spring steel shall conform to ASTM Designation: A 227M, Class 1. The diameter, length and type of shank and the number and type of washer shall be as recommended by the manufacturer for the types and thickness of material being anchored or fastened.

FABRICATION.--

Workmanship and finish.--Workmanship and finish shall be equal to the best general practice in modern shops.
Miscellaneous metal shall be clean and free from loose mill scale, flake rust and rust pitting, and shall be well formed and finished to shape and size with sharp lines and angles. Bends from shearing or punching shall be straightened.
The thickness of metal and details of assembly and support shall give ample strength and stiffness.
Built-up parts shall be true to line and without sharp bends, twists and kinks. Exposed ends and edges of metal shall be milled or ground smooth, with corners slightly rounded.
Joints exposed to the weather shall be made up to exclude water.

Galvanizing.--Items indicated on the plans to be galvanized shall be hot-dip galvanized after fabrication. The weight of galvanized coating shall be at least 460 grams per square meter of surface area, except drainage grates shall have at least 610 grams per square meter of surface area.

Painting.--Building miscellaneous metal items not galvanized shall be cleaned and prime painted prior to erection in accordance with the requirements specified for steel and other ferrous metals under "Painting" in Section 12-9, "Finishes," of these special provisions.

PART 3.- EXECUTION

GENERAL.--

Anchorages.--Anchorage devices and fasteners shall be provided for securing miscellaneous metal in-place construction; including threaded fasteners for concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws and other connectors.

Cutting, drilling and fitting shall be performed as required for installation of miscellaneous metal fabrications. Work is to set accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels.

Powder driven anchors.--Powder driven anchors shall be installed with low velocity powder actuated equipment in accordance with the manufacturer's instructions and State and Federal OSHA regulations.

DAMAGED SURFACES.--

General.--Galvanized surfaces that are abraded or damaged at any time after the application of the zinc coating shall be repaired by thoroughly wire brushing the damaged areas and removing all loose and cracked coating, after which the clean areas shall be painted with 2 applications of unthinned zinc-rich primer (organic vehicle type). Aerosol cans shall not be used.

SECTION 12-6. WOOD AND PLASTICS

12-6.01 ROUGH CARPENTRY

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing materials and performing rough carpentry work including wood framing, furring, and sheathing in accordance with the details shown on the plans and these special provisions.

Rough carpentry includes carpentry work not specified as part of other sections and which is generally not exposed.

SUBMITTALS.--

Product Data.--Manufacturer's material data and installation instructions shall be submitted for gypsum sheathing, framing hardware and underlayments.

Wood treatment data.--Chemical treatment manufacturer's instructions shall be submitted for the handling, sorting, installation, and finishing of treated materials.

> For each type of preservative treatment used, certification by treating plant shall include type of preservative solution and pressure process used, net amount of preservative retained and conformance with the applicable standards of the American Wood Preservers Association.

DELIVERY, HANDLING AND STORAGE.--

Delivery and storage.--Materials shall be kept under cover and dry. All materials shall be protected from exposure to weather and contact with damp or wet surfaces with blocking and stickers. All lumber, plywood and other panels shall be stacked in such a manner to provide air circulation within and around the stacks.

PART 2.- PRODUCTS

LUMBER.--

General.--Lumber shall be manufactured to comply with PS 20, "American Softwood Lumber Standard," and with applicable grading rules of inspection.

Softwood lumber shall be quality grade stamped or shall be accompanied by a certificate of inspection. Inspection certificates or grade stamps shall indicate compliance with the grading requirements of WWPA, WCLIB, RIS, or other approved lumber inspection agencies.

All lumber used shall be nominal sized and dressed S4S unless otherwise specified in these special provisions.

Framing lumber shall be solid stock lumber, Douglas Fir-Larch, and the grades indicated under WCLIB or WWPA rules. Moisture content shall not exceed 19 percent and shall be grade stamped "S-Dry."

DIMENSION LUMBER.--

Except as otherwise shown on the plans, lumber shall have the following grades.

Vertical framing lumber.--

Vertical framing lumber, nominal 51 mm x 51 mm through 102 mm x 102 mm, shall be Construction grade or better.

Vertical framing lumber, nominal 51 mm x 152 mm through 102 mm x 152 mm shall be No. 2 or better.

Horizontal framing lumber.--

Horizontal framing lumber, nominal 51 mm x 102 mm and wider, including joists and rafters, shall be No. 2 or better.

Horizontal framing lumber, nominal 102 mm x 102 mm and wider, including joist and rafters, shall be No. 1 or better.

Exposed framing lumber.--

Exposed framing lumber which is not concealed and is to receive a stain or natural finish shall be the same grade and species as indicated for structural framing and hand selected for appearance.

Miscellaneous lumber.--

Miscellaneous lumber for support or attachment of other work including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping and similar members shall be not less than No. 2 or better.

Lumber in contact with concrete or masonry construction shall be pressure treated Douglas Fir-Larch.

TIMBERS.--

Timbers (nominal 127 mm or thicker).--

Timbers shall be No. 1 or better.

PLYWOODPANELS.--

General.—Plywood panels shall comply with Voluntary Product Standard PS1, "U. S. Product Standard for Construction and Industrial Plywood."

Plywood panels shall be Group 1 unless otherwise noted.

Each plywood panel shall be factory marked with APA or other trademark evidencing compliance with grade requirements.

Structural plywood wall sheathing.--

Structural plywood wall sheathing for walls shall be APA RATED SHEATHING, Exposure 1. Thickness and grade shall be as shown on the plans.

Structural plywood roof sheathing.--

Structure plywood roof sheathing shall be APA RATED SHEATHING, Exposure 1. Span rating, thickness and grade shall be as shown on the plans.

MISCELLANEOUS MATERIALS.--

Rough Carpentry Hardware.--

Steel plates and rolled sections shall be mild, weldable steel, conforming to AISI grades 1016 through 1030 except 1017.

Nails, screws, bolts, nuts, washers shall be commercial quality. Exposed fasteners shall be hot dipped galvanized or stainless steel.

Joist hangers, clips and other standard framing hardware shall be ICBO approved, commercial quality, galvanized sheet steel or hot dipped galvanized, of the size shown on the plans.

Expansion anchors and powder driven anchors shall be as specified under "Building Miscellaneous Metal," in Section 12-5, "Metals," of these special provisions.

Nails.--

Nails shall conform to ASTM F 1667-95. "Common" nails shall conform to the following table:

Nail Size	Length (mm)	Diameter (mm)
8d	63.5	3.33
10d	76.2	3.76
16d	88.9	4.11

WOOD TREATMENT BY PRESSURE PROCESS.--

Preservative treatment.--

Preservative treatment shall be copper naphthenate, pentachlorophenol or water-borne arsenicals (ACA, CCA or ACZA).

The following items shall be treated:

Wood sills, sleepers, blocking, furring and other similar members in contact with concrete or masonry.

All holes, daps and cut ends of treated lumber shall be thoroughly swabbed with 2 applications of copper naphthenate.

PART 3.- EXECUTION

INSTALLATION.--

Wood framing.--Wood framing shall be in accordance with Chapter 23 of the California Building Code.

Framing members shall be of sizes and spacing shown on the plans. Unless otherwise shown on the plans, structural members shall not be spliced between supports.

Wood framing shall be accurately cut and assembled to provide closely fitted members. Framing shall be erected true to the lines and grades shown on the plans and shall be rigidly secured in place as shown and as required by recognized standards. Bracing shall be placed wherever necessary to support all loads on the structure during erection.

The size and spacing of fasteners and the edge distance for nails shall be as shown on the plans.

Nailing schedule shall be as shown on the plans and shall comply with the California Building Code.

Plywood panels.--Plywood panels shall be attached to the framing as shown on the plans and these special provisions. All structural plywood sheathing (both roof and wall) shall be nailed with "Common" nails.

Plywood sheathing shall be nailed to the framing system and shall be continuous over 2 or more supports. Roof panels shall be installed with the long dimension across the supports, with end joints staggered 1.22 m. Wall sheathing shall have all edges blocked. Spacing between panels shall be 3 mm.

12-6.02 GLUED LAMINATED MEMBERS

PART 1.- GENERAL

SUMMARY.--

Scope.--This work consists of furnishing and erecting pre-engineered, factory fabricated glued laminated members in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--

Product data.--Manufacturer's data, specifications and installation instructions for lumber, adhesives, fabrication process, preservative and fire-retardant treatment, accessories and protection shall be submitted for approval.

Working drawings.--Working drawings for glued laminated members shall be submitted for approval.

Working drawings shall include erection drawings, if required, and a location plan which shows the position and identification of each glued laminated member.

QUALITY ASSURANCE.--

Codes and standards.--Glued laminated members shall conform to American National Standards Institute (ANSI) Standard A190.1, "Structural Glued Laminated Timber."

Factory marks.--Glued laminated structural members shall be stamped with a APA EWS or similar mark which indicates that the member conforms to the requirements of ANSI Standard A190.1.

Such marks shall be placed on surfaces that will not be exposed in the completed work.

Certificates of Compliance.--Certificates of Compliance shall be furnished for glued laminated members in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

DELIVERY, STORAGE, HANDLING.--

Protection.--Water resistant wrapping on glued laminated members shall remain in place until units are erected.

Laminated members that are to be stored prior to erection shall be stored on blocks well off the ground with individual member separated for air circulation. Wrapping shall remain intact, lower side of wrapping shall be slit or punctured to permit drainage of water which may accumulate.

PART 2.- PRODUCTS

GLUED LAMINATED MEMBERS.--

Lumber.--

Glued laminated members shall be engineered, stress rated, factory laminated structural members with adhesive for wet use. Unless otherwise shown on the plans, structural glued laminated timber members shall be Combination 24F-V8 DF/DF for all cantilever beams and Combination 24F-V4 DF/DF for simple beam spans in accordance with AITC 117, "Design, Standard Specifications for Structural Glued Laminated Timber of Softwood Species."

Members shall be of Industrial Grade complying with AITC 110.

Penetrating sealers.--

Penetrating sealers shall be the manufacturers standard translucent penetrating sealer which will not interfere with the application of wood stain and transparent finish or paint finish as shown on the plans.

Connectors, anchors, accessories.--

Steel plates and rolled sections shall be mild, weldable steel, conforming to ASTM Designation: A 36.

Nails, screws, bolts, nuts, washers shall be commercial quality. Fasteners for galvanized hardware shall be hot-dip galvanized.

Joist hangers, clips and other standard framing hardware shall be commercial quality, galvanized sheet steel or hot-dipped zinc coated, manufacturer's standard units for timber sizes indicated.

Expansion anchors and powder driven anchors shall be ICBO approved for the purpose intended.

FABRICATION.--

General.--Glue laminated members shall comply with ANSI/AITC A190.1 as indicated.
Members shall be shop-cut for connections and connecting hardware to greatest extent feasible, including drilling of bolt holes.
Members shall have location placement identification marks or symbols which correspond to the approved location plan and shall have stamps or marks which indicate the top of each member.

Camber.--Unless otherwise shown on the plans, the camber shall be the manufacturer's standard camber, but shall not exceed a 610 m radius.

Preservative treatment.--The entire surface of the members, including ends, shall be sealed with a penetrating sealer immediately following manufacture.

Factory finishing.--Finish shall be manufacturer's standard "dry appearance" clear, penetrating acrylic stain-and-sealer, over dried and resistant to mildew and fungus.

Factory applied protection.--Before shipping, decking units shall be wrapped with manufacturer's standard, opaque durable, water-resistant, plastic coated paper covering with water resistant seams. Small members of uniform size may be bundle wrapped. Protective slip sheets shall be inserted between finished surfaces where factory finishes have been provided.

PART 3.- EXECUTION

INSTALLATION.--

General.--Miscellaneous steel connectors, anchors and accessories shall be installed as shown on the plans.
Members shall be erected so that a close fit and neat appearance of joints and structure as a whole will not be impaired.
Padded or non-marring slings shall be used when hoisting members. Corners shall be protected with wood blocking.

12-6.03 FINISH CARPENTRY

PART 1.- GENERAL

SUMMARY.--

Scope.--This work consists of furnishing and installing materials and performing finish carpentry, including interior trim, plywood ceilings and panels and plywood paneling, as shown on the plans and these special provisions.
Finish carpentry includes carpentry work not specified as part of other sections and which is generally exposed to view.

SUBMITTALS.--

Product data.--Manufacturer's specifications and installation instructions for each item of factory-fabricated siding and paneling.

Samples.--One sample shall be submitted to the Engineer at the jobsite for each species and cut or pattern of finish carpentry as shown below:

Interior standing and running trim - 610 mm long by full board or molding width, finished on one side and one edge.

Plywood paneling - 610 mm long x full panel width, finished on one side.

QUALITY ASSURANCE.--

Factory marks.--Each piece of lumber and plywood shall be marked with type, grade, mill and grading agency identification. Marks shall be omitted from surfaces to receive transparent finish. A mill certificate stating that material has been inspected and graded in accordance with requirements shall be furnished if marks cannot be placed on concealed surfaces.

PRODUCT DELIVERY, STORAGE AND HANDLING.--

Delivery.--Carpentry materials shall be delivered after painting, wet work and similar operations have been completed.

Protection.--Finish carpentry materials shall be protected during transit, delivery, storage and handling to prevent damage, soiling and deterioration.

PART 2.- PRODUCTS

WOOD PRODUCT QUALITY STANDARDS.--

Softwood lumber.--Softwood lumber shall conform to the requirements of PS 20, "American Softwood Lumber Standard," with applicable grading rules of inspection.

Plywood.--Plywood shall conform to the requirements of Voluntary Products Standard PS-1, "U. S. Product Standard for Construction and Industrial Plywood."

Woodworking.--Woodworking shall conform to the requirements of Woodwork Institute of California (WIC), "Manual of Millwork."

MATERIALS.--

General.--Lumber sizes indicated shall be nominal sizes except as indicated by detailed dimensions. Lumber which is to be dressed or worked and dressed shall be manufactured to the actual sizes as required by PS 20.

Plywood paneling and wainscotting.--

Plywood paneling and wainscotting shall be APA Interior Grade A-C, Group 1, Exposure 1 plywood. Thickness shall be as shown on the plans.

Interior standing and running trim.--

Standing and running trim to be painted shall be paint-grade pine, solid stock or finger jointed.

Standing and running trim to have transparent finish shall be solid hardwood, species to be shown on the plans.

Miscellaneous Materials.--

Nails, screws and other anchoring devices of the type, size, material and finish required shall be provided for secure attachment, concealed where possible.

Fasteners and anchorages for exterior use shall be hot dip galvanized.

PART 3.- EXECUTION

INSTALLATION.--

General.--All work shall be installed plumb, level and true with no distortions.

Standing and running trim.--Standing and running trim shall be installed with minimum number of joints possible, using full length pieces to the greatest extent possible.

Anchor finish carpentry.--Finish carpentry shall be anchored to framing or blocking built in or attached directly to the substrate.

Interior carpentry shall be attached to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing where required for complete installation. Fine finish nails shall be used for exposed nailing, countersunk and filled flush with finished surface.

ADJUSTMENT, CLEANING, FINISHING AND PROTECTION.--

General.--Damaged and defective finish carpentry work shall be repaired or replaced.

All exposed or semi-exposed surfaces shall be cleaned.

Finish carpentry shall be finished in accordance with the requirements specified under "Painting" in Section 12-9, "Finishes," of these special provisions.

12-6.04 CABINETS

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing wood cabinets and plastic laminate tops, splashes and returns as shown on the plans and in these special provisions.

SUBMITTALS.--

Product data.--Manufacturer's product data for plastic laminates and cabinet hardware shall be submitted for approval.

Samples.--Three samples shall be submitted for each of the items shown below:

Plastic laminate, 203 mm x 254 mm for each type, color, pattern and surface finish.

Working drawings.--Working drawings for cabinets showing location of cabinets, dimensioned plans and elevations, attachment devices and other components shall be submitted for approval. Working drawings shall bear the "WIC Certified Compliance Label" on the first sheet of the drawings.

QUALITY ASSURANCE.--

Codes and standards.--Cabinets and swinging gate shall be manufactured and installed in accordance with the Manual of Millwork of the Woodwork Institute of California (WIC) requirements for the grade or grades specified or shown on the plans.

Certificates of Compliance.--Prior to delivery to the jobsite, the cabinet manufacturer shall issue a WIC Certified Compliance Certificate indicating that the products he will furnish for this job and certifying that they will fully meet all the requirements of the grade or grades specified.

WIC Certified Compliance Label shall be stamped on all cabinet work and swinging gate.

Each plastic laminate top shall bear the WIC Certified Compliance Label.

Prior to completion of the contract, a WIC Certified Compliance Certificate for Installation shall be delivered to the Engineer.

DELIVERY, STORAGE AND HANDLING.--

Protection.--Cabinets shall be protected during transit, delivery, storage and handling to prevent damage, soiling and deterioration.

PART 2.- PRODUCTS

ACCEPTABLE MANUFACTURERS.--

Manufacturers.--Subject to compliance with these specifications, high pressure decorative laminates shall be Consoweld Corp.; Formica Corp.; Nevamar Corp.; or equal.

MANUFACTURED UNITS.--

General.--Cabinets shall be fabricated to the dimensions, profiles, and details shown on the plans with openings and mortises precut, where possible to receive hardware and other items and work.

Fabrication, assembly, finishing, hardware application, and other work shall be completed to the maximum extent possible prior to shipment to the jobsite.

Laminate clad cabinets.--

Laminate clad cabinets shall be custom grade, flush overlay construction.

Laminate cladding shall be high pressure decorative laminate complying with NEMA LD 3. Color, pattern and finish shall be as shown on the plans. Laminate surface and grade shall be as follows:

Horizontal and vertical surfaces other than tops shall conform to GP-50 (1.27 mm nominal thickness).

Postformed surfaces shall conform to PF-42 (1.07 mm nominal thickness).

Laminated counter tops and splashes.--

Laminated counter tops and splashes shall be WIC custom grade.

Surface material shall be high pressure laminated plastic conforming to NEMA LD-3, 1.27 mm thickness.

Unless otherwise shown on the plans, splashes shall be 102 mm high from the surface of the deck. Back splashes shall be continuous formed and coved. Side splashes shall be top set.

Laminated counter tops self edged, counter tops to receive sinks or plumbing fixtures shall have a bullnose.

The underside of tops and backsides of splashes shall be covered with an approved backing sheet.

CABINET HARDWARE AND ACCESSORY MATERIALS.--

General.--Cabinet hardware and accessory materials shall be provided for cabinets.
Hardware shall be provided with standard US 26D metal plated finish.

Drawer slides.--

Drawer slides shall be side mounting full extension with fully enclosed rolling balls and rollers. Concealed slides and bearings, and positive stop. Capacity shall be not less than 35 kg, except capacity shall be not less than 45 kg for heavy duty drawers.

Door guides.--

Sliding door guides shall be continuous, dual channel, metal guides, top and bottom. Bottom guide shall have crowned track.

Shelf supports.--

Shelf supports shall be adjustable, semi-recessed, chrome finished pressed metal, heavy duty standards and support clip, with one inch adjustment increments.

Cabinet hinges.--

Cabinet hinges shall be steel. Length of jamb leaf shall be 64 mm. The type of hinge shall be as shown on the plans.

Cabinet hinge manufacturers shall be Stanley, Hager, McKinney, or equal.

Cabinet catches.--

Cabinet catches shall be self-aligning magnetic type in aluminum case with zinc plated steel strike.

Cabinet catch manufacturers shall be Stanley, Hager, McKinney, or equal.

Cabinet pulls.--

Cabinet pulls shall be 8 mm diameter rod, with 33 mm projection and 75 mm center to center fastening.

Cabinet pull manufacturers shall be Stanley, Hager, McKinney, or equal.

FABRICATION.--

Shop assembly.--Nails shall be countersunk and the holes filled, molds shall be neatly mitered and all joints shall be tight and true.

As far as practicable, work shall be assembled at the mill and delivered to the building ready to be set in place. Parts shall be smoothly dressed and interior work shall be belt sanded at the mill and hand sanded at the building. After assembly, work shall be cleaned and made ready for the specified finish.

Veneer sequence matching shall be maintained of cabinets with transparent finish.

All work shall be prepared to receive finish hardware. Finish hardware shall be accurately fitted and securely fastened as recommended by the manufacturer. Finish hardware shall not be fastened with adhesives.

Drawers shall be fitted with dust covers of 6 mm plywood or hardboard above compartments and drawers except where located directly under tops.

Precut openings.--Openings for hardware, appliances, plumbing fixtures, and similar items shall be precut where possible. Openings shall be accurately located and templates used for proper size and shape. Edges of cutouts shall be smoothed and edges sealed with a water-resistant coating.

PART 3.- EXECUTION

INSTALLATION.--

Cabinets.--Cabinets shall be installed without distortion so that doors and drawers fit openings properly and are accurately aligned. Hardware shall be adjusted to center doors and drawers in openings and to provide unencumbered operation. Installation of hardware and accessory items shall be completed as indicated on the approved drawings.

Laminate tops.--Laminate tops shall be securely fastened to base units and other support systems as indicated on the approved drawings.

Cabinet hardware.--Doors for cabinets shall be equipped with one pair of hinges and one catch per leaf, unless otherwise shown on the plans. Each door leaf shall be equipped with one pull.

Drawers up to 610 mm wide shall have one pull and drawers over 610 mm wide shall have two pulls.

SECTION 12-7. THERMAL AND MOISTURE PROTECTION

12-7.01 WATER REPELLENT COATING

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and applying water repellent coating to concrete or masonry surfaces in accordance with the details shown on the plans and these special provisions.

The water repellent coating shall be applied to all exterior concrete or masonry surfaces and exposed aggregate surfaces as shown on the plans.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data, application instructions and general recommendations for water repellents shall be submitted for approval.

QUALITY ASSURANCE.--

Codes and standards.--Water repellent coatings shall comply with all rules and regulations concerning air pollution in the State of California.

Certificates of Compliance.--Certificates of Compliance shall be furnished with each shipment of water repellent coating materials in accordance with Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

PART 2.- PRODUCTS

Water repellent coating.--

Water repellent coating shall be clear, colorless, water-based sealer. Water repellent coating shall be Hydrozo Inc., Clear Double 7; Euclid Chemical Co., Architectural Seal VOX; Tamms Industries Co., Chemstop; or equal.

PART 3.- EXECUTION

Preparation.--All surfaces to receive water repellent coating shall be dry and cleaned by removing contaminants that block pores of the surface. Cleaning methods shall be as recommended by the water repellent manufacturer.

Application.--The water repellent solution shall be applied in accordance with the manufacturer's printed instructions
The time period between applications of water repellent coating shall be not less than 24 hours.

Protection.--Surfaces of other materials surrounding or near the surfaces to receive the water repellent coating shall be protected from overspray or spillage from the waterproofing operation. Water repellent coating applied to surfaces not intended to be waterproofed shall be removed and the surfaces restored to their original condition.

12-7.02 INSULATION (GENERAL)

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing insulation in accordance with the details shown on the plans and these special provisions.
Insulation materials shall be as specified in these special provisions, and shall be compatible with existing or new materials incorporated in the building.

SUBMITTALS.--

Product data.--A list of materials, manufacturer's descriptive data, location schedule, and time schedule shall be submitted for approval.
The list of materials to be used shall include the trade name, manufacturer's name, smoke developed and flame spread classification, resistance rating and thickness for the insulation materials and accessories.

Schedules.--A location schedule and time schedule shall be submitted for approval.
The location schedule shall show where each material is to be installed.
The Contractor shall provide the Engineer at the jobsite with an accurate time schedule of the areas of the building to be insulated each day. The time schedule shall be submitted 3 working days in advance of the work.

Samples.--Samples of insulation material shall be submitted to the Engineer at the jobsite.

QUALITY ASSURANCE.--

Codes and standards.--All insulating materials shall be certified to comply with the California Quality Standards for Insulating Materials and shall be listed in the Department of Consumer Affairs publication "Consumer Guide and Directory of Certified Insulation Material."

DELIVERY, STORAGE AND HANDLING.--

General.--Insulating materials shall be delivered to the jobsite and stored in a safe dry location with labels intact and legible.
Insulating materials shall be protected from physical damage and from becoming wet or soiled.

In the event of damage, materials shall be repaired or replaced as necessary to comply with these specifications.

PART 2.- PRODUCTS (Not applicable.)

PART 3.- EXECUTION (Not applicable.)

12-7.03 BATT AND BLANKET INSULATION

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing batt or blanket insulation in accordance with the details shown on the plans and these special provisions.

Batt insulation shall include faced and unfaced batts in walls and ceilings, acoustical batts for sound control and exposed batt or blanket insulation for ceilings and walls.

QUALITY ASSURANCE.--

Codes and standards.--All batt or blanket insulation, including facings such as vapor barriers, shall have a flame-spread rating not to exceed 25 and a smoke density not to exceed 450 when tested in accordance with UBC Standard No. 8-1.

The flame-spread and smoke density limitations do not apply to facings on batt insulation installed between ceiling joists, or in roof-ceiling or wall cavities, provided the facing is installed in substantial contact with the surface of the ceiling or wall finish.

PART 2.- PRODUCTS

INSULATING MATERIALS.--

General.--Fiberglass batts shall be thermal insulation produced by combining glass fibers with thermosetting resins to comply with ASTM Designation: C 665.

Wall insulation.--

Wall insulation shall be R-2.3 K• m^2/W fiberglass batts with paper-laminate vapor-retarder membrane on one face. Insulation shall conform to ASTM Designation: C 665, Type II, Class C.

Ceiling insulation.--

Ceiling insulation shall be R-3.3 K• m^2/W fiberglass batts with paper-laminate vapor-retarder membrane on one face. Insulation shall conform to ASTM Designation: C 665, Type II, Class C.

Acoustical insulation.--

Acoustical insulation shall be 89 mm, unfaced fiberglass insulation batts. Insulation shall conform to ASTM Designation: C 665, Type I.

VAPOR-RETARDERS.--

Paper-laminate vapor-retarder.--

Paper-laminate vapor-retarder shall be kraft paper sheets laminated together with asphalt or other vapor retarding compounds, scrim reinforced at edges of sheets.

AUXILIARY INSULATION MATERIALS.--

Insulation tape.--

Insulation tape shall be as recommended by the insulation manufacturer.

PART 3.- EXECUTION

INSTALLATION.--

General.--The vapor retarder on faced batts shall be toward the interior and shall be fastened to provide a sealed retarder. Punctures and holes in the retarder shall be repaired.

Unless otherwise shown on the plans or specified elsewhere in these special provisions, insulation shall be kept 75 mm to 100 mm clear of lighting fixtures and heat producing electrical appliances and equipment.

Installing batt type insulation.--Insulation batts shall be installed to completely fill the space between framing members. Apply a single layer of insulation of required thickness, unless otherwise shown on the plans or required to make up total thickness. Installation shall conform to the manufacturer's recommendations and these special provisions.

12-7.04 RIGID WALL INSULATION

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing rigid wall insulation in accordance with the details shown on the plans and these special provisions.

Rigid insulation shall include rigid insulation, wood nailers, fasteners and such other materials, not mentioned, which are required for the complete installation of the rigid insulation system.

QUALITY ASSURANCE.--

Codes and standards.--Rigid foam insulation shall have a flame-spread rating not to exceed 75 and a smoke density not to exceed 450 when tested in accordance with UBC Standard No. 8-1. Rigid foam insulation shall be approved in accordance with UBC Standard 26-3 to be installed exposed, or without a thermal barrier on the room side of the insulation.

PART 2.- PRODUCTS

Rigid insulation.--

Rigid insulation shall be rigid rectangular boards of polyisocyanurate foam with aluminum foil facing on both sides and an aged thermal resistance of R-1.9 $K \bullet m^2/W$. Facing on exposed insulation shall be white tinted aluminum foil.

Wood nailers.--

Wood nailers shall be Douglas fir, Hem-fir or equivalent western softwood. Nailers in contact with masonry or concrete shall be pressure treated after fabrication. Wood preservatives shall be waterborne type.

Insulation tape.--

Insulation tape shall be as recommended by the insulation manufacturer.

Adhesive.--

Adhesive shall be construction grade panel adhesive as recommended by the insulation manufacturer.

PVC strips.--

PVC strips shall be interlocking male and female white PVC strips.

Fasteners.--

Fasteners shall be concrete nails; Bostich, Pneumatic Nail System; Buildex, Tampcon Fasteners; or equal.

EXECUTION.--

Installation of rigid insulation.--The preparation of the wall surfaces and the installation of insulation shall conform to the manufacturer's recommendations and these special provisions.

Rigid insulation placed behind plywood or gypsum board shall be tight fitting between nominal 51 mm x 102 mm wood nailers laid flat and spaced 0.6 meter on center. Wood nailers shall also be placed at the top and bottom of the plywood or gypsum board.

Exposed rigid insulation shall be installed tight fitting between PVC strips spaced at 1.2 meter on center. PVC strips shall align with the vertical joints of the plywood below. Adhesive shall be applied to the PVC strips and the wall as recommended by the insulation manufacturer. Exposed insulation shall have no horizontal joints between the top of the plywood and the bottom of the trusses.

All joints between insulation boards and between insulation boards and wood nailers shall be taped.

Insulation panels with broken or crushed corners or edges shall be trimmed free of such defects or shall be discarded. Replacement boards less than 300 mm wide shall not be used.

Damaged insulation in the completed work shall be removed and replaced. Insulation that has been wet or is wet shall be considered damaged.

12-7.05 RIGID ROOF INSULATION

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing rigid roof insulation in accordance with the details shown on the plans and these special provisions.

Rigid insulation shall include rigid insulation, fasteners and such other materials, not mentioned, which are required for the complete installation of the rigid insulation system. Materials and installation shall be coordinated with the roof covering system to meet the requirements for a Class 1, I-90, Factory Mutual approved assembly.

Codes and standards.--Rigid foam insulation shall have a flame-spread rating not to exceed 75 when tested in accordance with UBC Standard No. 8-1.

PART 2.- PRODUCTS

Rigid roof insulation.--

Rigid insulation shall be rigid rectangular boards of polyisocyanurate foam with facing on both sides. Thickness shall be as shown on the plans.

Insulation tape.--

Insulation tape shall be as recommended by the insulation manufacturer.

Fastener (metal decking).--

Fastener (metal decking) shall be as recommended by the manufacturer.

PART 3.-EXECUTION

Preparation.--The preparation of the deck surfaces shall conform to the manufacturer's recommendations and these special provisions.

The deck surface shall be made smooth and level.

Installation.--Insulation panels shall be placed with end joints staggered and with joints of the second layer, if multi-layer insulation is used, offset at least 150 mm from joints in the first layer.

The completed layer of insulation shall be smooth and level, and suitable for the proper bedding of succeeding layers of roofing material.

Insulation shall be laid just before application of roofing. Units shall be laid in parallel courses with transverse joints staggered, in moderate contact with adjoining surfaces.

Continuous joints between insulation units and parallel to decking flutes shall not occur over the flute openings. Both units shall have full edge bearing on rib tops.

Insulation panels with broken or crushed corners or edges shall be trimmed free of such defects or shall be discarded. Replacement boards less than 305 mm wide shall not be used.

Damaged insulation in the completed work shall be removed and replaced. Insulation that has been wet or is wet shall be considered damaged.

12-7.06 ROOF BOARD

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing roof board in accordance with the details shown on the plans and these special provisions.

Roof board shall include, fasteners and such other materials, not mentioned, which are required for the complete installation of the roof board system. Materials and installation shall be coordinated with the roof covering system to meet the requirements for a Class 1 Factory Mutual approved assembly.

SYSTEM DESCRIPTION.--

Design Requirements.--The roof board installation shall conform to the wind design requirements for uplift in Chapter 16 of the California Building Code for the wind speed and exposure shown on the plans.

SUBMITTALS.--

Product Data.--Manufacturer's technical product data, installation instructions, and recommendations for each type of roof board material shall be submitted for approval.

Product data shall include the manufacturer's name and a complete material description of all components of the roof board installation.

Working Drawings.--Working drawings showing the layout and details of the roof board installation shall be submitted for approval.

Working drawings shall show the shape, size, thickness, and method of attachment for each component used in the work; the layout and spacing of fasteners; and details of connections.

Design calculations for the fastening system with the roof board shown on the plans shall be submitted to verify compliance with the design requirements.

Working drawings and design calculations shall be stamped and signed by an engineer who is registered as a Civil or Structural Engineer in the State of California. The expiration date of the registration shall be shown. The Engineer's signature shall be original.

QUALITY ASSURANCE.--

Certificates of Compliance.--Certificates of Compliance shall be furnished for the roof board system in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

DELIVERY, HANDLING AND STORAGE.--

Delivery and handling.--Panels shall be protected against damage and discoloration.

Storage.--Panels shall be stored above ground, with one end elevated for drainage and protected against standing water and condensation between adjacent surfaces.

PART 2.- PRODUCTS

Roof board.--

Roof board shall be panels 1.2 m by 2.4 m or greater long, 13 mm to 16 mm in thickness. Long edges of panels shall be interlocking and panels shall have guide markings clearly printed on the top surface of each board to facilitate the proper location and spacing of the screw fasteners. Roof board shall be Loadmaster, Mineral Board; Georgia Pacific, DensDeck; or equal.

Fastener (metal decking).--

Fastener (metal decking) shall be galvanized spring steel barbed clip driven through galvanized 25 mm minimum nominal diameter caps; galvanized hardened steel nail with 25 mm minimum nominal diameter head and serrated shank to provide backout resistance; or threaded self tapping screw driven through 75 mm minimum nominal diameter galvanized cap.

EXECUTION.--

Preparation.--The preparation of the insulation surfaces shall conform to the manufacturer's recommendations and these special provisions.

The insulation surface shall be made smooth and level.

Installation.--The roof board shall be mechanically fastened as shown on the approved working drawings. Panels that are cracked or broken by the installation of the mechanical fasteners shall be replaced.

The completed layer of roof board shall be smooth and level, and suitable for the proper bedding of succeeding layers of roofing material.

Continuous joints between roof board units and parallel to insulation units below shall be offset 150 mm.

Roof boards with broken or crushed corners or edges shall be trimmed free of such defects or shall be discarded. Replacement boards less than 305 mm wide shall not be used.

Damaged roof board in the completed work shall be removed and replaced. Roof board that has been wet or is wet shall be considered damaged.

12-7.07 SPRAYED-ON FIREPROOFING

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and applying a cementitious, sprayed-on fireproofing to structural members in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data and application instructions shall be submitted for approval.

Descriptive data shall include trade names, manufacturers' names, complete information on the materials to be applied, the material thickness for columns and beams for the required fire resistance ratings, and the manufacturer's printed instructions for application.

QUALITY ASSURANCE.--

Codes and standards.--Sprayed-on fireproofing shall have a maximum flame spread rating of 10, and smoke development of 0 in accordance with ASTM Designation: E 84.

Single source responsibility.--Fireproofing materials shall be purchased from a single supplier.

Maximum allowable asbestos content.--Sprayed-on fireproofing materials containing mineral aggregates or fiber shall contain more than 0.25 percent by weight of asbestos of any type.

Certificates of Compliance.--Certificates of Compliance shall be furnished for sprayed-on fireproofing materials in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

DELIVERY, STORAGE AND HANDLING.--

General.--Materials to be applied shall be delivered in original unopened packages. Packages shall be identified by the manufacturer's label and shall bear proper UL or FM labels for fire resistance classification.

Materials shall be stored above ground, under cover, and in a dry location until ready for use. Packages which have been exposed to moisture before use shall be discarded.

PART 2.- PRODUCTS

Fireproofing.--

Fireproofing shall be sprayed on cementitious or mineral fiber fireproofing conforming to ASTM Designation: E 119.

Fireproofing primer and adhesive.--

Fireproofing primer and adhesive shall be as recommended by the fireproofing manufacturer.

PART 3.- EXECUTION

Preparation.--Surfaces to be fireproofed shall be clean and dry, and shall be free from rust, grease, dust, and other deleterious materials which could impair the bond of the fireproofing.

Prior to applying fireproofing, clips, hangers, support sleeves and other attachments required to penetrate the fireproofing shall be in place.

Ducts, piping, equipment or other suspended matter which would interfere with the application of fireproofing materials shall not be positioned until fireproofing work is completed.

Surfaces not to receive sprayed on fireproofing shall be protected from the overspray of the fireproofing materials.

Application.--Equipment and application procedure shall be as recommended by the fireproofing manufacturer.

The primer and fireproofing materials shall be applied in accordance with the fireproofing manufacturer's application instructions.

The final wet film thickness of sprayed on fireproofing materials shall be as required to achieve the fireproofing manufacturer's specified resistance rating.

The material thickness shall be measured on the basis of the wet film thickness and shall be determined by random measurements during application.

Patching and repairing of sprayed on fireproofing shall be done by spraying or hand troweling.

Clean-up.--Work areas shall be maintained in an orderly condition. Upon completion of the installation, all debris and equipment shall be removed from the job site.

12-7.08 THROUGH-PENETRATION FIRESTOPPING

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing firestopping materials at penetrations in fire-rated walls, floors, and ceilings in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--

Product data.--A list of materials, manufacturer's descriptive data, and location schedule shall be submitted for approval.

Descriptive data shall include trade names, manufacturers' names, complete information on the materials to be applied, approved lab Listing, the material thickness for the required fire resistance ratings, and the manufacturer's printed instructions for installation. Manufacturer's assembly shall be California State Fire Marshal approved.

QUALITY ASSURANCE.--

Certificates of Compliance.--Certificates of Compliance shall be furnished with each shipment of firestopping materials in accordance with Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

DELIVERY, STORAGE AND HANDLING.--

Delivery.--Materials to be applied shall be delivered in original unopened packages. Packages shall be identified by the manufacturer's label and shall bear proper labels for fire resistance classification.

Storage.--Materials shall be stored above ground, under cover, and in a dry location until ready for use. Packages which have been exposed to moisture before use shall be discarded.

PART 2.- PRODUCTS

Fire-rated caulk.--

Fire-rated caulk shall conform to ASTM Designation: E 814 and shall be rated for use in one-hour fire-rated assemblies. Fire-rated caulk shall be 3M Brand, Fire Barrier Caulk; Dow Corning, Fire Stop Sealant; Standard Oil, Fyre Putty; or equal.

Wrap strip.--

Wrap strip shall be nominal 6 mm thick intumescent elastomeric material in 50 mm wide strips, faced one side with aluminum foil, and rated for use in 1-hour and 2-hour fire-rated systems.

Packing material.--

Packing material shall be polyethylene backer rod or nominal one inch thickness of tightly packed ceramic (alumina silica) fiber blanket, mineral-wool batt or glass fiber insulation material.

Fire-rated mortar.--

Fire-rated mortar shall be non-asbestos, 753 to 913 kilograms per cubic meter air dried density portland cement fly ash through-penetration firestopping mortar. Fire-rated mortar shall conform to ASTM Designation: E 814 and shall be rated for use in 3-hour fire-rated systems at 75 mm minimum thickness.

Fire safing insulation.--

Fire safing insulation shall be inorganic 56 kilograms per cubic meter minimum density, non-combustible fiber insulation conforming to Federal Specifications HH-1-521F, when tested in accordance with ASTM Designation: E 119 and ASTM Designation: E 136 for 3 hour fire resistance.

PART 3.-EXECUTION.--

Installation.--Firestopping materials shall be installed to conform to the requirements of the California State Fire Marshal Listing and the manufacturer's recommendations.

12-7.09 WATER / ICE BARRIER

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing water / ice barrier with in accordance with the details shown on the plans and these special provisions.

Water / ice barrier shall consist of membrane, which is required for a complete, self adhering and weather tight installation.

SUBMITTALS.--

Product data.--Manufacturer's technical product data, samples, installation instructions and recommendations for water / ice barrier membrane shall be submitted for approval.

Product data shall include the manufacturer's name and a complete material description for the membrane.

Samples.--Material samples shall not be less than 200 mm x 200 mm in size.

DELIVERY, HANDLING AND STORAGE.--

General.--Membrane shall be protected against damage and discoloration.

Membrane shall be stored above ground, with one end elevated for drainage and protected against standing water and condensation between adjacent surfaces.

WARRANTY.--

Warranty.--Membrane shall be warranted to be free of defects in manufacture.

PART 2.- PRODUCTS

WATER / ICE BARRIER.--

Membrane.--

Water / ice barrier shall be a cold applied, self-adhering membrane not less than 40 mils thickness, composed of high strength polyethylene film coated on one side with a thick layer of adhesive-consistency rubberized asphalt. The membrane shall be inter-wound with a disposable silicone coated release sheet.

Water / ice barrier shall be W. R. Grace & Co.-Conn., Ice and Water Shield; Protector Wrap, Jiffy Seal; or equal

PART 3.- EXECUTION.--

INSTALLATION.--

General.--Water / ice barrier shall be installed in accordance with the manufacturer's instructions and recommendations.

The membrane shall be applied directly to plywood substrate. The substrate shall be dry and cleaned of dust, dirt, loose nails or other protrusions from deck.

Water / ice barrier shall be applied only in fair weather at temperatures of 4.4°C or higher.

12-7.10 PREFINISHED METAL ROOFING

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing preformed metal roofing in accordance with the details shown on the plans and these special provisions.

Metal roofing system shall consist of prefinished metal roof panels, trim, flashings, counterflashings, reglets, concealed fasteners, sealants, and other accessories and components, not mentioned, which are required for a complete, securely fastened and weathertight installation.

SYSTEM DESCRIPTION.--

Design Requirements.--The roofing system shall conform to the wind design requirements for uplift in Chapter 16 of the California Building Code for the wind speed and exposure shown on the plans.

SUBMITTALS.--

Product Data.--Manufacturer's technical product data, installation instructions, and recommendations for each type of roofing material shall be submitted for approval.

Product data shall include the manufacturer's name and a complete material description of all components of the metal roofing system.

Samples.--Material samples shall include a 305 mm x 305 mm sample of the roofing panel for each color to be installed and a sample of each anchor clip and fastening device.

Working Drawings.--Working drawings showing the layout and details of the metal roofing shall be submitted for approval.

Working drawings shall show the shape, size, thickness, and method of attachment for each component used in the work; the layout and spacing of fasteners; details of connections and closures; and details for expansion joints and weathertight joints.

Design calculations for the fastening system with the substrate shown on the plans shall be submitted to verify compliance with the design requirements.

Working drawings and design calculations shall be stamped and signed by an engineer who is registered as a Civil or Structural Engineer in the State of California. The expiration date of the registration shall be shown. The Engineer's signature shall be original.

QUALITY ASSURANCE.--

Certificates of Compliance.--Certificates of Compliance shall be furnished for the metal roofing system in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

DELIVERY, HANDLING AND STORAGE.--

Delivery and handling.--Panels shall be protected against damage and discoloration.

Storage.--Panels shall be stored above ground, with one end elevated for drainage and protected against standing water and condensation between adjacent surfaces.

PART 2.- PRODUCTS

MATERIALS.--

SHEET MATERIAL.--

Base metal.--

Base metal shall be cold formed, 0.71 mm (24-gage), galvanized sheet steel conforming to ASTM Designation: A 653/A 653M, Grade 33 [230] with G90 [Z275] coating, except where a higher strength is required for performance, extra smooth; or cold formed aluminum-zinc alloy-coated, commercial quality, sheet steel conforming to ASTM Designation: A 792/A 792M, Grade 40 [275] with AZ55 [AZM 165], coating extra smooth.

Configuration.--

Metal roofing system shall be a standing seam system with standing rib a minimum of 45 mm high and spaced not less than 305 mm nor more than 460 mm on center.

METAL FINISHES.--

General--Coatings shall be applied before or after forming and fabricating panels, as required for maximum coating performance capability.

Colors shall be as shown on the plans.

Fluoropolymer coating.--

Finish shall be the manufacturer's standard Kynar coating with a baked on primer (0.005 mm) and a finish coat of 0.02 mm nominal for a total dry film thickness of approximately 0.025 mm nominal.

Interior finish shall consist of a 0.004 mm epoxy primer and a backer coat.

MISCELLANEOUS METAL SHAPES.--

Flashings, counterflashings, and reglets.--

Flashings, counterflashings and reglets shall be formed from the same material, gage and in the same color and finish as the roofing panels.

Soffit panels.--

Soffit shall be smooth, flat, 305 mm wide and shall be formed from the same material, gage and in the same finish as the roof panels. Color shall be as shown on the plans.

MISCELLANEOUS MATERIALS--

Fastener clips.--

Fastener clips shall be noncorrosive ferrous metal fasteners as recommended by the metal roofing system manufacturer to resist the design loads.

Fasteners.--

Fasteners shall be as recommended by the metal roofing system manufacturer. Sheet metal screws shall not be used except to fasten trim and flashings.

Underlayment.--

Underlayment shall be as specified under "Water/Ice Barrier" elsewhere in this Section of these special provisions.

Sealant and sealant tape.--

Sealant and sealant tape shall be as recommended by the roofing manufacturer.

Closures.--

Closures shall be rubber, neoprene, closed cell plastic or prefinished metal.

Snow guards.--

Snow guard shall be as specified under "Snow Guards" elsewhere in this Section of these special provisions.

FABRICATION.--

General.--Unless otherwise shown on the plans, or specified herein, roof panels shall be fabricated in continuous lengths for the length of the roof, from ridge or peak to eave, except such length shall not exceed the manufacturer's maximum production length. Flashings shall be fabricated in the longest practical lengths.

Roofing panels shall be factory formed. Field formed panels are not acceptable.

PART 3.- EXECUTION.--

INSTALLATION.--

Roof panels.--The roof system shall be installed and fastened in accordance with the details shown on the plans and the approved working drawings. Cutting and fitting shall present a neat and true appearance with exposed burrs removed. Openings through roof panels shall be cut square and shall be reinforced as recommended by the metal roofing system manufacturer.

Roof panels shall be adjusted in place and properly aligned for the detailed conditions before fastening. Panels shall not be warped, bowed or twisted. The surface finish on the panels shall not be cracked, blemished or otherwise damaged.

Gaskets, joint fillers, sealants and sealing tape shall be installed where indicated on the approved drawings or as required for weatherproof performance of panel systems.

Fasteners shall not be driven through roof panels or batten covers.

Miscellaneous metal shapes.--Trim, fascia, flashings, and other prefinished metal work shall be positioned to the correct alignment for each detailed condition. Metal work shall be securely attached to backing using fasteners at the spacing shown on approved working drawings.

Roof panels, trim, and other prefinished metal that are marred, punctured, incorrectly bent, or incorrectly installed will be considered damaged and shall be replaced with undamaged units.

The metal roofing system shall be installed weathertight. Closures shall be tight fitting and shall be provided at the ends of panels, at the boundary of the roof, and as indicated on the approved working drawings.

CLEAN UP AND CLOSE OUT.--

Clean up.--Adjacent surfaces shall be protected during the roofing system installation and sealant work. Excess sealant shall be removed as the installation progresses.

Roof panels, molding, trim, and other prefinished metal surfaces shall be cleaned after installation as recommended by the manufacturer. Exposed cuts shall be touched-up with a matching durable primer and paint as recommended by the metal roofing system manufacturer.

Touch up.--Damaged paint surfaces shall be touched up by using an air dry touch up paint supplied by the metal roofing system manufacturer. Only a small brush shall be used for touching up. No spraying of touch up paint is to be performed.

Damaged units.--Panels and other components of the work which have been damaged or have deteriorated beyond successful repair shall be removed and replaced.

12-7.11 SNOW GUARDS

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing snow guards in accordance with the details shown on the plans and these special provisions.

Snow guards shall include roof seam clamps, color strip, fastening bolts, snow slips and accessories needed to provide a complete installation.

Related work.--Metal roofing shall be in accordance with the requirements specified under "Metal Roofing" in this Section 12-7, of these special provisions.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data, and installation instructions shall be submitted for approval.

Samples.--Three samples of the complete snow guard assembly shall be submitted for approval.

DELIVERY, STORAGE, AND HANDLING.--

Delivery.--Materials shall be delivered in original packages and containers with seals unbroken and bearing manufacturer's labels containing brand name.

Storage.--Materials shall be kept dry and protected from the weather.

PART 2.- PRODUCTS

Snow guards.--

Snow guards shall be 6061 T6 extruded aluminum, approximately 50 mm high, designed to receive a color strip and attach to the roof seam clamps with bolts and washers.

Roof seam clamps.--

Roof seam clamps shall be 6061 T6 extruded aluminum designed as appropriate for the roof seam profile and attached to the roof seam with 2 set screws.

Fasteners.--

Fasteners shell be Series 300 stainless steel bolts, washers and set screws. Bolts and set screws shall have a minimum diameter of 9.5 mm. Set screws shall have a rounded nose point to prevent damage to the panel finish.

Color strips.--

Color strips shall be prefinished metal of the same material and color as the prefinished metal roof panel.

PART 3.- EXECUTION

Installation.--Snow guards shall be installed true to line in accordance with the manufacturer's recommendations.

Set screws shall be on the same side of the roof seam clamp and on the same side of the roof seam throughout the installation. Set screws shall be torqued as recommended by the manufacturer to provide maximum holding strength. Set screws shall not penetrate the roof seam.

Snow guard installation shall not impair drainage of the roof.

12-7.12 SHEET METAL FLASHING

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of fabricating, furnishing and installing sheet metal flashing in accordance with the details shown on the plans and these special provisions.

Sheet metal shall include metal flashings, counterflashings, straps, and roof jacks.

Alternatives.--Premolded roof flashings may be used in lieu of sheet metal flashings where shown on the plans.

QUALITY ASSURANCE.--

Codes and standards.--Sheet metal work shall in accordance with the requirements in the latest edition of the Sheet Metal and Air Conditioning Contractors National Association "Standard Practice in Architectural Sheet Metal Work."

PART 2.- PRODUCTS

MATERIALS.--

Galvanized sheet steel.--

Galvanized sheet steel shall conform to ASTM Designation: A 361, not less than 0.71 mm (24-gage), unless otherwise shown on the plans. Surfaces to be painted shall not have factory coatings on galvanizing that cannot be removed by paint thinner.

Sheet aluminum.--

Sheet aluminum shall be not less than 0.81 mm thick, mill finish, 3003-H14 alloy, conforming to ASTM Designation: B 209.

Sheet lead.--

Sheet lead shall be not less than 1.6 mm thick, made from chemical lead, conforming to ASTM Designation: B 29.

Premolded roof flashing.--

Premolded flashing shall be premolded neoprene or ethylene propylene diene monomer (EPDM) flashing, resistant to ozone and ultraviolet. Units shall have overlapping tab to flash the seam.

Hardware and fastenings.--

Hardware and fastening for premolded roof flashings shall be stainless steel.

Solder.--

Solder shall conform to ASTM Designation: B 32, Alloy Grade Sn50.

Soldering flux.--

Soldering flux shall be acid type, conforming to Federal Specification: O-F-506C, Type I, Form A.

Lap joint sealant.--

Lap joint sealant for concealed locations shall be a non-drying butyl.

Flashing cement.--

Flashing cement shall be a bituminous plastic cement, asbestos free, conforming to ASTM Designation: D 4586, Type II.

Sealant.--

Sealant for exposed locations shall be a silicone sealant conforming to ASTM Designation: C 920.

Primer.--

Primer shall be as recommended by the sealant manufacturer.

Coal tar paint.--

Coal tar paint shall be coal-tar epoxy coating conforming to U.S. Corps of Engineers Specification: C-200 or Steel Structures Painting Council Paint Specification: SSPC-16-68T.

FABRICATION.--

General.--Sheet metal shall be assembled to Sheet Metal and Air Conditioning Contractors National Association Standards.

Sheet metal shall be formed to the sizes, shapes and dimensions shown on the plans or as specified herein with angles and lines straight, sharp and in true alignment. The number of joints shall be kept to a minimum.

Angle bends and folds for interlocking the metal shall be made with full regard for expansion and contraction to avoid buckling or fullness in the metal after it is installed.

Joints in sheet metal work shall be closed watertight unless slip joints are specifically required. Watertight joints shall be mechanically interlocked and then thoroughly soldered for metals other than aluminum. Watertight joints in aluminum or between aluminum and other metals shall be sealed with acrylic sealant.

Sheet metal joints to be soldered shall be cleaned with steel wool or other means, pre-tinned and soldered watertight.

All joints shall be wiped clean of flux after soldering. Acid flux shall be neutralized by washing the joints with sodium bicarbonate.

Flashings shall have a 45 degree drip return at bottom edges. Unless otherwise shown on the plans, counterflashing shall extend not less than 100 mm over roofing or other materials protected by the counterflashing and shall be arranged so that roofing or materials can be repaired without damage to the counterflashing. Where reglets are indicated, counterflashing shall be fastened by lead wedges or snap-in flashing.

PART 3.- EXECUTION

PREPARATION.--Surfaces to receive sheet metal shall be clean, smooth and free from defects.

PROTECTION.--Aluminum surfaces to be in contact with concrete, mortar, or dissimilar metals shall be given a heavy coat of coal tar paint.

INSTALLATION.--

Roof penetration flashings.--All pipes, vents and flues passing through roofs shall be made waterproof with flashings of storm collars or counterflashings.

Roof penetration flashings shall be fabricated from galvanized sheet steel, not less than 0.71 mm (24-gage). Size and shape shall be as shown on the plans.

Premolded roof flashings.--Premolded roof flashings shall be installed in accordance with the manufacturer's instructions.

12-7.13 ROOF SPECIALTIES

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing roof specialties in accordance with details shown on the plans and these special provisions.

Roof specialties shall include prefabricated curb units.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data, rough-in diagrams, installation instructions and general product recommendations shall be submitted for approval.

QUALITY ASSURANCE.--

Labels.--Units shall be provided which have been tested, listed, and bear the label of UL, FM or other recognized testing agency.

Codes and standards.--Prefabricated units shall conform to the requirements of SMACNA, "Architectural Sheet Metal Manual," details for fabrication of units, including flanges and cap flashing to coordinate with types of roofing involved.

PART 2.- PRODUCTS

General.--Manufacturer's standard units, modified as necessary, shall be provided to comply with the contract requirements. Each unit shall be shop fabricated to the greatest extent possible.

MATERIALS.--

Sheet steel.--

Sheet steel shall be structural quality conforming to the requirements of ASTM Designation: A 570.

Insulation.--

Insulation shall be the manufacturer's standard rigid or semi-rigid board of glass fiber and shall be the thickness required.

Fasteners.--

Fasteners shall be the same metal as the metal to be fastened, or other non-corrosive metal as recommended by the unit manufacturer. Finish of the fastener shall be the same finish as the metal being fastened.

Bituminous coating.--

Bituminous coating shall be as recommended by the unit manufacturer for the use specified.

Gaskets.--

Gaskets shall be tubular or fingered design of neoprene or polyvinyl chloride as recommended by the unit manufacturer.

PREFABRICATED CURB.--

General.--Curb shall conform to the loading and strength requirements of the equipment to be supported. Dimensions shall conform to the dimensions shown on the coordination drawings of equipment to be supported. Unit shall be fabricated from sheet steel conforming to ASTM Designation: A 570 and galvanized after fabrication.

Units shall be fabricated with welded or sealed mechanical corner joints, complete with cant strips and base profile coordinated with roof slope. Wood nailers shall be provided at top of curb tapered as necessary to compensate for roof slopes of 2%.

Curb supports shall be fabricated with height tapered to provide a level installation.

PART 3.- EXECUTION

INSTALLATION.--

General.--Prefabricated units shall be installed in accordance with the manufacturer's instructions and approved coordination drawings.

Installation of the units shall be coordinated with installation of the roof decking and flashing materials.

Units shall be securely fastened to supporting members, adequate to withstand all lateral, inward or outward loading pressures.

Except as noted above, roof flanges shall be set in a thick bed of roofing cement to form a watertight seal.

Operational testing.--Units with operational components shall be fully tested. Joints and hardware shall be cleaned and lubricated. All units shall be adjusted for proper operation.

CLEANING AND PROTECTION.--

General.--All exposed metal and plastic surfaces shall be cleaned in accordance with the manufacturer's instructions. Damaged metal coatings shall be repaired.

12-7.14 SEALANTS AND CAULKING

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and applying sealants and caulking which are required for this project, but not specified elsewhere, in accordance with the details shown on the plans and these special provisions.

QUALITY ASSURANCE.--

Certificates of Compliance.--Certificates of Compliance shall be furnished for the sealants and caulking in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data and installation instructions for all sealants shall be submitted for approval.

Samples.--Color samples of all sealants shall be submitted for approval.

PART 2.- PRODUCTS

MATERIALS.--

General.--All sealants, primers and accessories shall be non-staining to adjacent exposed surfaces. Products having similar applications and usage shall be of the same type and same manufacturer. Gun consistency compound shall be used unless otherwise required by the job conditions.

Acrylic sealant.--

Acrylic sealant shall be one compound, solvent release acrylic sealant.

Butyl sealant.--

Butyl sealant shall be one component, skinning type.

Silicone sealant.--

Silicone sealant shall be one component, low modulus building sealant. Sealant shall be tack-free in one hour, shall not sag or flow, shall be ozone resistant and capable of 100 percent extension without failure.

Joint sealant.--

Joint sealant shall be a two-part, non sag polysulfide base, synthetic rubber sealant formulated from liquid polysulfide polymer.

Backer rod.--

Backer rod shall be round, open or closed cell polyurethane. Backer rod shall be sized such that it must be compressed between 25 and 75 percent of its uncompressed diameter during installation in the joint.

Neoprene.--

Neoprene shall conform to the requirements of ASTM Designation: C 542.

PART 3.- EXECUTION

APPLICATION.--

General.--Unless otherwise shown on the plans, sealants shall be applied in accordance with the manufacturer's instructions.

Silicone sealants shall not be used in locations where painting is required.

Butyl sealants shall not be used in exterior applications, and acrylic sealants shall not be used in interior applications.

Sealants shall be applied in a continuous operation for the full length of the joint. Immediately following the application of the sealant, the sealant shall be tooled smooth using a tool similar to that used to produce concave masonry joints. Following tooling, the sealant shall remain undisturbed for not less than 48 hours.

SECTION 12-8. DOORS AND WINDOWS

12-8.01 HINGED DOORS

GENERAL.--This work shall consist of furnishing and installing hinged doors and frames in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--Manufacturer's descriptive data, installation instructions for fire rated assemblies and a door schedule shall be submitted for approval. The door schedule shall include a description of the type, location and size of each door and frame.

PRODUCTS.--

Wood door.--

Wood door shall be Woodwork Institute of California (WIC) "Custom" grade flush, hollow or solid core wood doors as shown on the plans. Face shall be stain grade hardwood veneer except as otherwise shown on the plans. Doors shall bear the WIC quality grade mark or shall be accompanied by a Certificate of Compliance certifying compliance with the WIC quality specified herein. Certificates of Compliance shall be in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

Metal door.--

Metal door shall be flush, seamless steel door factory prepared and reinforced to receive hardware and having cold rolled stretcher leveled sheet steel face sheets not less than 1.2 mm thick (18-gage). Face sheets shall be bonded with thermosetting adhesive to rigid board honeycomb or precured foam core; or face sheets shall be welded to all

parts of an assembled grid of cold formed pressed metal stiffeners and framing members located around edges, ends, openings and at all locations necessary to prevent buckling of face sheets. Seams shall be tack welded, filled and ground smooth. Bottom edge and internal stiffeners of grid type core shall have moisture vents. Welds on exposed surfaces shall be ground smooth. Louvered or glazed openings shall be provided where shown on the plans.

Where fire rated doors are required, doors shall be listed and labeled for the fire rating shown on the plans.

Active leaf of double door shall have a full height astragal of 3 mm flat bar or folded sheet strip, not less than 1.5 mm thick (16-gage), welded on the outside of the active leaf.

Door shall be cleaned and treated by the bonderized process or approved phosphatizing process and then given one factory application of metal protective rust inhibitive primer. Primer shall not contain lead type pigments.

Glazing for doors.--

Glazing for doors shall be safety glass as specified under "Glazing" in Section 12-8, "Doors and Windows," of these special provisions. Glazing shall be not less than 5 mm thick.

Door louvers.--

Door louvers shall be inverted V-type factory primed, galvanized sheet steel louvers. Exterior door louvers shall not be removable from outside of the building. Louvers at exterior doors shall have inside mounted bronze insect screens.

Louvers shall be cleaned and treated by the bonderized process or approved phosphatizing process and then given one factory application of metal protective rust inhibitive primer. Primer shall not contain lead type pigments.

Pressed metal frame.--

Pressed metal frame shall be not less than 1.5 mm thick (16-gage) sheet steel with integral stop, mitered corners, face welded and ground smooth corners. Frames shall be reinforced for all hardware and shall be cleaned and treated by the bonderized process or an approved phosphatizing process and then given one factory application of metal protective rust inhibitive primer. Primer shall not contain lead type pigments.

Frames for fire rated doors shall be listed for the same rating shown on the plans for fire rated doors.

Sealants.--

Sealants shall be ultraviolet and ozone resistant, gun grade polysulfide or polyurethane, multicomponent, Federal Specification: TT-S-227.

EXECUTION.--

INSTALLATION.--Doors and frames shall be installed rigidly, securely, plumb and true and in such a manner that the doors operate freely without rubbing or binding. Clearance between frame and door shall be not more than 3 mm. The exterior frame shall be sealed weathertight.

Pressed metal frames shall be secured with clips and anchors as shown on the plans.

Fire rated assemblies shall be installed according to the manufacturer's recommendations.

Fire rated assemblies shall include doors, door frames, automatic smoke-actuated closers, self-closing mechanisms, panic hardware, wire glass, and fire rated louvers. Assemblies shall be approved by the California State Fire Marshal.

PAINTING.--Except for the primer application specified herein, doors and frames shall be cleaned, prepared and painted in accordance with the requirements specified under "Painting" in Section 12-9, "Finishes," of these special provisions.

12-8.02 ATTIC ACCESS DOORS

GENERAL.--This work shall consist of furnishing and installing attic access doors in accordance with the details shown on the plans and these special provisions

SUBMITTALS.--Manufacturer's descriptive data and installation instructions shall be submitted for approval.

PRODUCTS.--

Access doors.--

Access doors shall be factory assembled and factory prime painted steel. Door panel shall be 1.90 mm thick (14-gage) and door frame shall be 1.5 mm thick (16-gage) . The door and frame assembly shall have standard screw driver operated cam locks, concealed springs or continuous piano hinge and inside release handle. Access doors shall be by Babcock-Davis Hatchways, Bar-Co Access Doors, Inryco-Milcor, J.L. Industries, or equal.

EXECUTION.--

INSTALLATION.--Access doors shall be installed in accordance with the manufacturer's recommendations.
The access door assemblies shall be painted to the match the color of the adjacent surrounding surfaces.

12-8.03 SECTIONAL OVERHEAD DOORS

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing sectional overhead doors in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data, roughing-in diagram and installation instructions for each size and type of door shall be submitted for approval.

Manufacturer's descriptive data shall include door panel construction and material thickness, door track size and material thickness, counterbalance spring service life and motor operator specifications.

Materials list shall contain all items proposed to be furnished and installed under this section of these special provisions.

Working drawings shall show details of special components and installations which are not fully dimensioned in manufacturer's descriptive data.

QUALITY ASSURANCE.--

Single source.--Each sectional door shall be provided as a complete unit produced by one manufacturer, including frames, sections, bracket guides, tracks, counterbalance mechanisms, hardware, operators and installation accessories, to suit opening and head room available.

Wind loading.--Design and reinforce section overhead doors to withstand a 960 PA wind load with a midspan deflection not to exceed 1/120 span.

PART 2.- PRODUCTS

MANUFACTURERS.--

Available manufacturers.--Subject to compliance with the specifications, manufacturers offering products which may be incorporated into the work include, but are not limited to the following: Clopay Corp.; Overhead Door Corp.; Raynor Garage Doors.

STEEL SECTIONS.--

Door sections.--

Door sections shall be galvanized commercial quality steel sheets and a minimum of G60 zinc coating complying with ASTM Designation: A 525.

Face sheets shall be not less than 0.86mm (20-gage). Back sheet shall be not less than 0.45 mm (26-gage).

Sections shall be fabricated from a single sheet to provide sections not more than 610 mm high, and nominal 50 mm deep. Meeting horizontal edges shall be rolled to a continuous shiplap, rabbeted. or keyed weather seal, with a reinforcing flange return.

Intermediate and end stiles shall be 1.52 mm (16-gage) galvanized steel welded in place. Intermediate stiles shall be spaced at not more than 1220 mm on center.

Bottom section shall be reinforced with a continuous channel or angle conforming to the bottom section profile.

Insulation.--

Insulation shall be the manufacturer's glass fiber, polystyrene or polyurethane foam type insulation and have an R-Value not less than 1.4 $K \cdot m^2/W$.

Finish.--

Finish shall be the manufacturer's standard baked on polyester prime coat, applied to interior and exterior faces. Final exterior finish on door sections and components shall be field applied in accordance with the requirements specified under "Painting" in Section 12-9, "Finishes," of these special provisions.

TRACKS, SUPPORTS. AND ACCESSORIES.--

Door tracks.--

Door tracks shall be the manufacturers standard galvanized steel track system, sized for door size and weight, and designed for the clearances shown on the plans. Complete track assembly shall be provided, including brackets, bracing and reinforcing for rigid support of ball bearing roller guides, for required door type and size.

Track reinforcement and supports.--

Track reinforcement and supports shall be galvanized steel. Tracks shall be reinforced and supported as required for the size and weight of door to provide strength and rigidity, and to ensure against sag, sway and vibration during operation.

Door seals.--

Doors shall have perimeter gasket seals at head and jambs and seal shall have a replaceable vinyl or neoprene bottom seal.

Vision panels.--

Vision panels shall be door manufacturer's standard glazed opening with wire safety glass, metal frame and vinyl or neoprene glazing gasket for water tight construction. The approximate size shall be as shown on the plans.

Operable louvers.--

Operable louvers shall be factory fabricated units of extruded aluminum alloy not less than 2.0 mm thick or galvanized steel not less than 0.91 mm thick (20-gage) with standard "Z" type blades set in a continuous channel frame, with a 6 mm mesh galvanized bird-screen in a removable frame on the inside.

Blades shall have center pivot on 10 mm aluminum rods in stainless steel ball bearings in cadmium plated races.

Operable louvers shall be equipped with hand-hold fixed to the operating bar for easy adjustment with wingnut spring tension to lock louvers in desired position.

HARDWARE.--

General.--Hardware shall be heavy-duty, rust-resistant, with galvanized or cadmium-plated or stainless steel fasteners, to suit type of door.

Hinges.--

Heavy steel hinges shall be provided at each end stile and at intermediate stiles, per manufacturer's recommendations for size of door.

Rollers.--

Rollers shall be heavy-duty with steel ball bearings in case-hardened steel races, mounted to suit slope of track. Rollers shall have case-hardened tires.

COUNTERBALANCE MECHANISMS.--

Counterbalance spring.--

The door shall have a torsion spring counterbalance on a continuous cross header shaft; the entire assembly shall be all-bearing mounted. The spring shall have a rated service life of not less than 25,000 cycles.

ELECTRIC DOOR OPERATORS.--

Door operator shall be heavy duty, commercial type. Motor shall be a 37 kW 240-volt, 3-phase, high starting torque motor with single reduction worm gear, completely housed and running in an oil bath. Motor shall be of sufficient capacity to raise and lower the door at speed of approximately 0.2 m per second.

Door operator and assembly shall be equipped with solenoid brake, limit switches for upper and lower limits of door travel, emergency hand chain with electrical interlock to break motor circuit when hand chain is engaged, 3-button operating station in a NEMA Type 4 enclosure, and a factory wired NEMA Type 1 control panel.

Control panel shall contain an instrument transformer, reversing magnetic contactor with overload relay, and all necessary control relays and other devices required for complete automatic operation of the door. Motor shall be removable for repair without affecting emergency operation. Motor shall be centermounted or sidemounted as shown on the plans.

Reversing door edge.--

Reversing door edge shall be an electrically or pneumatically operated safety device extending across the full width of the bottom of the door which shall cause the door to stop automatically and return to open position upon contact with any obstruction.

PART 3.- EXECUTION

INSTALLATION.--

General.--Door, track, and operating equipment, complete with necessary hardware, jamb and head mold stops, anchors, inserts, hangers, and equipment supports, shall be installed in accordance with the final drawings, manufacturer's installation instructions and these special provisions.

Vertical track assembly shall be fastened to framing at not less than 610 mm on center. Horizontal track shall be hung from structural overhead framing with angle or channel hangers, welded or bolted into place. Sway bracing, diagonal bracing, and reinforcing as required for rigid installation of track and door operating equipment.

12-8.04 WINDOWS

PART 1.- GENERAL

SUMMARY.--This work shall consist of furnishing and installing windows in accordance with the details shown on the plans and these special provisions.

Windows shall be commercial (C) grade aluminum prime windows unless otherwise shown on the plans.

Windows shall meet the requirement of NAFS-1, "Voluntary Performance Specification for Windows, Skylights, and Glass Doors," and shall meet the C30 (Commercial) product designation unless otherwise shown on the plans. Windows shall be labeled with the AAMA label.

Finish for windows shall be a factory finish as shown in the plans.

Glazing for windows shall be in accordance with the requirements specified under "Glazing" in Section 12-8, "Doors and Windows," of these special provisions.

CERTIFICATES OF COMPLIANCE.--Certificates of Compliance shall be furnished for all windows in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

SUBMITTALS.--Manufacturer's descriptive data, installation instructions and schedule shall be submitted for approval.

Manufacturer's descriptive data and installation instructions shall show window elevations, plan views, full size sections, anchoring details to all substrates, anchors and hardware.

Installation schedule shall show location, size and type for each window.

PART 2.- PRODUCTS

Door windows.--

Door windows shall be door or door frame manufacturer's standard window framing, glazing stops and glazing accessories.

Fixed windows.--

Fixed windows shall be non-operable glazed panel inserted into a frame to include muntins, glazing stops, and glazing accessories.

Horizontal sliding windows.--

Horizontal sliding windows shall be horizontal slide by windows with tightly contacting weatherstripped meeting stiles, self-lubricating rollers, glazing accessories, tubular sill, snap locks and push handle. Vents shall be screened.

Aluminum.--

Aluminum shall be extruded 6063-T5 aluminum alloy.

Screws, fasteners and window accessories.--

Screws, fasteners and window accessories shall be non-corrosive metals compatible with aluminum except guides and rollers may be vinyl and nylon respectively. Finish for locks, operators, strikes, keepers and other metal hardware shall match window finish.

Weatherstripping.--

Weatherstripping shall be continuous, replaceable type, wool pile mounted in metal or double runs of ultraviolet resistant neoprene or vinyl.

Vent screen.--

Vent screen shall be aluminum frame with 18 x 14 mesh aluminum screening and polyvinyl-chloride splines. Screen frames shall be removable from interior of building. Finish of screen frame shall match window finish.

Sealant.--

Sealant shall be single-component, solvent type acrylic, self-leveling, non-sag, conforming to Federal Specification: TT-S-230.

Tape.--

Tape shall be compatible with sealant; Pecora, "B-44 Extra-Seal;" Pittsburg Plate Glass, "Duribbon;" Protective Treatment, "PTU 606;" Tremco, "440 Tape;" or equal.

PART 3.- EXECUTION

FABRICATION.--Frame and sash shall be accurately machined and fitted to hairline joinery that develops the members. Joints shall be factory sealed weathertight.

Sash shall be removable from the interior only. Sash shall have concealed condensation weeps to the outside.

DELIVERY AND STORAGE.--Windows shall be delivered in original, unopened, unbroken containers, wrappings, or bags with labels bearing the brand name, name of manufacturer or supplier, standard of manufacture, and product description.

Windows and accessories shall be stored off the ground, kept dry, fully protected from weather and damage

INSTALLATION.--Window units shall be set straight, level, plumb and in true alignment in prepared openings. Windows shall be centered in openings. Clearance between the window unit and the building framing shall be from 4 mm to 6 mm at the sides and 13 mm at the top. Ventilator sash shall be adjusted after glazing for easy, smooth and proper operation.

The installation shall be flashed and sealed weathertight.

All aluminum surfaces in contact with masonry, steel or other incompatible materials shall be isolated with pressure sensitive tape, zinc chromate primer, bituminous paint or such other material recommended by the window manufacturer and approved by the Engineer.

12-8.05 PRESSED METAL FRAMED WINDOWS

PART 1.- GENERAL

SUMMARY.--This work shall consist of furnishing and installing pressed metal framed windows in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--Manufacturer's descriptive data, working drawings and installation instructions shall be submitted for approval.

PART 2.- PRODUCTS

Framing.--

Framing shall be pressed metal, not less than 1.52 mm thick (16-gage) with all members square and true, full mitered frame corners and continuous welds at all joints and cover plates. Welds at frame faces shall be ground smooth and flush with surrounding surfaces. All metal surfaces shall be cleaned and factory primed with one coat of metal protective rust inhibitive primer. Primer shall not contain lead type pigments.

Anchors.--

Anchors shall be manufacturer's standard.

Glazing.--

Glazing shall conform to the requirements specified under "Glazing," in Section 12-8, "Doors and Windows," of these special provisions.

Backer rod.--

Backer rod shall be close cell, non-absorbent, non-staining foam rod compatible with sealant.

Sealant.--

Sealant shall be ultraviolet and ozone resistant, gun grade polysulfide or polyurethane, single component. Sealant shall conform to Federal Specification: TT-S-227.

PART 3.- EXECUTION

INSTALLATION.--Frames shall be installed rigidly, securely, plumb and true. Installations shall be sealed watertight and weathertight.

PAINTING.--Except for the primer application specified herein, exposed frame surfaces shall be cleaned, prepared and painted in accordance with the requirements specified under "Painting" in Section 12-9, "Finishes," of these special provisions.

12-8.06 FIRE RATED WINDOW ASSEMBLY

GENERAL.--This work shall consist of furnishing and installing fire rated window assemblies in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--Manufacturer's descriptive data, working drawings and installation instructions, and listing information shall be submitted for approval.

PRODUCTS.--

Fire rated window assembly.--

Fire rated window assembly shall be a factory-fabricated fixed glazed assembly with a steel frame and shall conform to CBC Section 713.3 and shall be tested in accordance with UBC Standard 7-4. Window assembly shall have a label or listing mark, showing the fire-protection rating.

Welds at frame faces shall be ground smooth and flush with surrounding surfaces. All metal surfaces shall be cleaned and factory primed with one coat of metal protective rust inhibitive primer. Primer shall not contain lead type pigments.

Anchors.--

Anchors shall be manufacturer's standard.

Backer rod.--

Backer rod shall be close cell, non-absorbent, non-staining foam rod compatible with sealant.

Sealant.--

Sealant shall be ultraviolet and ozone resistant, gun grade polysulfide or polyurethane, single component. Sealant shall conform to Federal Specification: TT-S-227.

EXECUTION.--

INSTALLATION.--Fire rated window assembly shall be installed in accordance with its listing and the manufacturer's recommendations.

Frames shall be installed rigidly, securely, plumb and true. Installations shall be sealed watertight and weathertight.

PAINTING.--Except for the primer application specified herein, exposed frame surfaces shall be cleaned, prepared and painted in accordance with the requirements specified under "Painting" in Section 12-9, "Finishes," of these special provisions.

12-8.07 FINISH HARDWARE

PART 1.- GENERAL

SUMMARY.--

This work shall consist of furnishing and installing hardware items for doors in accordance with the details shown on the plans and these special provisions.

Hardware assemblies shall comply with the fire code and the disabled accessibility requirements indicated on the plans and specified in these special provisions.

SUBMITTALS.—

Manufacturer's technical information and catalog cuts for each item of door hardware and a door hardware schedule shall be submitted for approval prior to installation.

Manufacturer's catalog cuts shall include catalog numbers, material, grade, type, size, function, design, quality and finish of hardware.

The door hardware schedule shall indicate the location and size of door opening, the door and frame material, and the size, style, finish and quantity of the hardware components required.

FINISHES.—

Hardware shall be provided with standard US 26D metal plated finish.

KEYING INSTRUCTIONS.—

New locks shall be compatible with the master key system of the existing facility and shall be keyed to the Schlage lock system in use (verify).

Locks and cylinders shall be provided with six pin "O" cylinders and blank keys. Cylinders and blank keys shall be delivered to the Engineer for combinating of cylinders and cutting of keys.

The Contractor shall provide cylinders for use during construction. Construction cylinders shall remain in place until permanent cylinders are installed. Construction cylinders shall remain the property of the Contractor.

Key bows shall be stamped "State of California" and "Do Not Duplicate."

PART 2.- PRODUCTS.--

GENERAL.—

Door hardware equal in material, grade, type, size, function, design, quality and manufacture to that specified herein may be submitted for approval.

Butt hinges.--

Butt hinges shall be steel, 1 1/2-pair per door unless otherwise specified or shown on the plans. Nonremovable pins shall be provided at outswing exterior doors. Hinge size shall be 114 mm x 114 mm unless otherwise noted.

Standard weight hinges shall be:

Hager	BB 1279
McKinney	TB 2714
Stanley	BB 179
or equal.	

Mortise locksets.--

Mortise locksets shall be steel case with 32 mm x 203 mm face plate and 70 mm backset. Door and frame preparation for mortise locksets shall conform to ANSI A115.1.

Lever operated lockset shall be:

Best	35H 6FW 15H
Falcon	LM521 DG
Schlage	L9453P x 06
or equal.	

Cylindrical locksets, latchsets and privacy sets.--

Cylindrical locksets, latchsets and privacy sets shall be steel chassis, 54 mm diameter, 70 mm backset. Door and frame preparation for cylindrical lockset, latchsets and privacy sets shall conform to ANSI A115.1.

Lever operated lockset shall be:

Best	83K6 AB 9C
Schlage	D53PD RHO
Falcon	LY501 DG
or equal.	

Lever operated latchset shall be:

Best	83K ON 9C
Falcon	LY101 DG
Schlage	D10S RHO
or equal.	

Lever operated privacy set shall be:

Best	83K OL 9C
Falcon	LY301 DG
Schlage	D40S RHO
or equal.	

Flush bolts.--

Flush bolts shall be installed at the top and bottom of the inactive leaf of pairs of doors. Provide automatic bolts on UL rated pairs of doors.

Flush bolts for manual operation shall be:

Builders Brass	5020
Glynn Johnson	FB6
H.B. Ives	457
or equal.	

Door closers.--

Parallel arms for closers shall be installed at outswing exterior doors. Closers shall have sprayed finish to match other hardware on door.

Door closers shall be:

LCN	4040
Norton	85001
Dorma	7800
or equal.	

Pushplates and pullplates.--

Pushplates and pullplates shall be 102 mm x 406 mm x 1.52 mm (16-gage). Grips shall be 25 mm diameter with 38 mm standoff and 203 mm center to center fastening, unless indicated otherwise.

Pushplates shall be:

Builders Brass	47
Quality	40
Trimco	1001-3
or equal.	

Pullplates shall be:

Builders Brass	47x290-1
Quality	1515
Trimco	01-3 x 1193-2
or equal.	

Kickplates.--

Kickplates shall be 254 mm in height x 51 mm less than door width x 1.52 mm (16-gage).

Kickplates shall be:

Builders Brass	37
Quality	48
Trimco	6000
or equal.	

Floor mounted stops.--

Floor mounted stops shall be dome type. The height of the stop shall be determined by the clearance required when a threshold is used or not used.

Stops for openings without thresholds shall be:

Builders Brass	8061
Quality	331
Trimco	1210
or equal.	

Stops for openings with thresholds shall be:

Builders Brass	8063
Quality	431
Trimco	1213
or equal.	

Wall bumpers.--

Wall bumpers base diameter shall be 64 mm with a 25 mm projection.

Bumpers shall be:

Builders Brass	WC9
Quality	302
Trimco	1272-1/4-CCS
or equal.	

Thresholds, rain drips, door sweeps and door shoes.--

Thresholds, rain drips, door sweeps and door shoes shall conform to the sizes and configurations shown on plans. Thresholds at door openings with accessibility requirements shall not exceed 13 mm in height.

Threshold, rain drip, door sweep and door shoe manufacturers shall be Pemko, Reese, Zero, or equal.

Threshold bedding sealant.--

Threshold bedding sealant shall conform to Federal Specification: SS-C-153.

Weatherstrip.--

Weatherstrip shall conform to the sizes and shapes shown on plans. Assemblies shall be UL listed and shall be provided where shown on the plans or as specified in these special provisions.

Weatherstrip manufacturers shall be Pemko, Reese, Zero, or equal.

Door signs and name plates.--

Door signs and name plates shall be as specified under "Signs" in Section 12-10, "Specialties," of these special provisions.

PART 3.- EXECUTION

DOORS AND FRAMES.--Doors and frames shall be set square and plumb and be properly prepared before the installation of hardware.

INSTALLATION.--Hardware items shall be accurately fitted, securely applied, and adjusted and lubricated in accordance with the manufacturer's instructions. Installation shall provide proper operation without bind or excessive play.

Hinges shall be installed at equal spacing with the center of the end hinges not more than 244 mm from the top and bottom of the door. Pushplates and door pulls shall be centered 1118 mm from the finished floor. Locksets, latchsets, privacy sets and panic exit mechanisms shall be 1024 mm from the finished floor. Kickplates shall be mounted on the push side of the doors, 25 mm clear of door edges.

Thresholds shall be set in a continuous bed of sealant material.

Door controls shall be set so that the effort required to operate doors with closers shall not exceed 37.8 N maximum for exterior doors and 22.3 N maximum for interior doors. The effort required to operate fire doors may be increased above the values shown for exterior and interior doors but shall not exceed 66.7 N maximum.

Door stops located on concrete surfaces shall be fastened rigidly and securely in place with expansion anchoring devices. Door stops mounted elsewhere shall be securely attached with wood screws or expansion devices as required.

Backing shall be provided in wall framing at wall bumper locations.

The location and inscriptions for door signs and name plates shall be as shown on the plans.

Hardware, except hinges, shall be removed from surfaces to be painted before painting.

Upon completion of installation and adjustment, the Contractor shall deliver to the Engineer all dogging keys, closer valve keys, lock spanner wrenches, and other factory furnished installation aids, instructions and maintenance guides.

DOOR HARDWARE GROUPS AND SCHEDULE.--Hardware groups specified herein shall correspond to those shown on the plans:

GROUP 1

1 1/2-pair butt hinges
1 each lever operated mortise lockset
1 each door closer
1 each kickplate
1 each floor mounted door stop
1 each weatherstrip
1 each door shoe with drip
1 each threshold

GROUP 2

3-pair butt hinges
1 each lever operated mortise lockset
1 each flush bolt
2 each kickplate
1 each astragal on active leaf
1 each weatherstrip
2 each door shoe with drip
2 each door closer

GROUP 3

1 1/2-pair butt hinges
1 each lever operated cylindrical lockset
1 each door closer
1 each kickplate
1 each floor mounted door stop

GROUP 4

1 1/2-pair butt hinges
1 each lever operated cylindrical lockset
1 each kickplate
1 each wall bumper

GROUP 5

1 1/2-pair butt hinges
1 each lever operated privacy set
1 each kickplate
1 each wall bumper

GROUP 6

1 1/2-pair butt hinges
1 each door closer
1 each pushplate
1 each pullplate
1 each kickplate
1 each wall bumper
1 each threshold

GROUP 7

1 1/2-pair butt hinges
1 each lever operated cylindrical latchset
1 each door closer
1 each kickplate
1 each floor mounted door stop

GROUP 8

1 1/2-pair butt hinges
1 each lever operated cylindrical lockset
1 each kickplate
1 each floor mounted door stop
1 each door shoe with drip

12-8.08 GLAZING

PART 1.- GENERAL

SUMMARY.---

This work shall consist of furnishing and installing glazing in accordance with the details shown on the plans and these special provisions.

Glazing shall consist of glass sheets for windows and doors.

All glass shall conform to ASTM Designation: C 1036 and the classifications specified herein and shall be clear glass except as noted.

Safety glass shall be furnished and installed at all locations designated in Consumer Product Safety Commission's Safety Standard For Architectural Glazing Materials 16 CFR 1201.

SUBMITTALS.—

A detailed list of glazing materials including glass, sheet, sealants, tapes, setting blocks, shims, compression seals, and glazing channels shall be submitted for approval. The list shall include a schedule of the materials to be used at each location.

LABELS.—

Each individual pane of heat strengthened or fully tempered glass shall bear an identification label in accordance with ASTM Designation: C 1048.

PART 2.- PRODUCTS

Sheet glass, float glass, or plate glass.--

Sheet glass, float glass, or plate glass shall be Type I, Class 1, Quality q4 or better, double strength for panes to 0.93 m^2, 5 mm thick for panes between 0.93 m^2 and 2.6 m^2, and 6 mm thick for panes over 2.6 m^2, except as otherwise shown on the plans.

Obscure glass.--

Obscure glass shall be Type II, Class 1, Form 3, Quality q8, Finish f1, Pattern p1 or p2; 3 mm thick flat figured glass, one surface smooth, other surface fine grid pattern.

Safety glass.--

Safety glass shall conform to Consumer Product Safety Commission Safety Standard For Architectural Glazing Materials: 16 CFR 1201, and ANSI Standard Z97.1 and shall be one of the following:

Tempered glass.--

Tempered glass shall conform to ASTM Designation: C 1048, Kind FT, Condition A, Type 1, Quality q4 or better.

Wire glass.--

Wire glass shall be Type II, Class 1, Form 1, Mesh m1; 6 mm thick clear polished wire glass with diamond mesh.

Tinted glass.--

Tinted glass shall be bronze; all the same tint.

Insulating glass assemblies.--

Insulating glass assemblies shall be double pane units consisting of 2 pieces of glass separated by a spacer and hermetically sealed with double seal sealants. The entrapped air shall be at atmospheric pressure and maintained in a hydrated condition by a drying agent located in the spacer

Seals, caulks, putties, setting blocks, shims, tapes, compression seals, felt, spacers, and channels.--

Seals, caulks, putties, setting blocks, shims, tapes, compression seals, felt, spacers, and channels shall be top grade, commercial quality, as recommended by the glass or sheet manufacturer and shall conform to the requirements in the publications of the Flat Glass Marketing Association.

PART 3.- EXECUTION

INSTALLATION.—

Glazing shall conform to the general conditions and applicable details in the publications of the Flat Glass Marketing Association.

Cut edges of tinted glass shall conform to the recommendations of the glass manufacturer. The glazier shall inspect each edge of tinted glass. Panes with edges that do not conform to the manufacturer's standards for tinted glass edges for sunny elevations shall not be used.

Panes shall be bedded fully and evenly, set straight and square within panels in such a manner that the pane is entirely free of any contact with metal edges and surfaces.

For all panes on the exterior of the building, the glazing on both sides of window panes shall provide a watertight seal and watershed. Seals shall extend not more than 2 mm beyond the holding members. A void shall be left between the vertical edges of the panes and the glazing channel. Weep systems shall be provided to drain condensation to the outside.

Panes in assemblies using extruded gasket glazing shall be set in accordance with the assembly manufacturer's instructions using gaskets and stops supplied by the manufacturer.

Whenever welding or burning of metal is in progress within 4.6 m of glazing materials, a protective cover shall be provided over exposed surfaces.

REPLACEMENT AND CLEANING.—

All broken or cracked glass and glass with scratches which reduce the strength shall be replaced before completion of the project.

Panes shall be kept clean of cement and plaster products, cleansers, sealants, tapes and all other foreign material that may cause discoloration, etching, staining, or surface blemishes to the materials.

Excess sealant left on the surface of the glass or surrounding materials shall be removed during the work life of the sealant.

Solvents and cleaning compounds shall be chemically compatible with materials, coatings and glazing compounds to remain. Cleaners shall not have abrasives that scratch or mar the surfaces.

All panes shall be cleaned just before the final inspection. All stains and defects shall be removed. Paint, dirt, stains, labels (except etched labels), and surplus glazing compound shall be removed without scratching or marring the surface of the panes or metal work.

SECTION 12-9. FINISHES

12-9.01 GYPSUM WALLBOARD

GENERAL.--This work shall consist of furnishing, installing and finishing gypsum wallboard in accordance with the details shown on the plans and these special provisions.

Where assembly fire ratings are indicated on the plans, construction shall provide the fire resistance in accordance with the applicable standards in the Fire Resistance Design Manual published by the Gypsum Association.

Wallboard backing for use in restroom and shower areas shall be water-resistant gypsum backing board.

PRODUCTS.--

Gypsum wallboard.--

Gypsum wallboard shall conform to ASTM Designation: C 36/C 36M.

Water-resistant gypsum backing board.--

Water-resistant gypsum backing board shall conform to ASTM Designation: C 630/C C 630M.

Joint tape and joint and finishing compound.--

Joint tape and joint and finishing compound shall conform to ASTM Designation: C 475.

Corner beads, metal trim and control joints.--

Corner beads, metal trim and control joints shall be galvanized steel of standard manufacture.

Resilient metal channel.--

Resilient metal channel shall be galvanized sheet steel channels of standard manufacture for reducing sound transmission in wood frame partitions.

Fasteners.--

Fasteners shall be gypsum wallboard nails conforming to ASTM Designation: C 514 or steel drill screws conforming to ASTM Designation: C 1002.

EXECUTION.--

DELIVERY AND STORAGE.--Materials shall be delivered in original packages, containers or bundles bearing brand name, applicable standard of manufacture, and name of manufacturer or supplier and shall be kept dry and fully protected from weather and direct sunlight exposure. Gypsum wallboard shall be stacked flat with adequate support to prevent sagging or damage to edges, ends and surfaces.

INSTALLATION.--Wallboard panels to be installed on ceilings and soffits shall be installed with the long dimension of the panels perpendicular to the framing members. Wallboard panels to be installed on walls may be installed with the long dimension of the panels either parallel or perpendicular to the framing members. The direction of placing the panels shall be the same on any one wall or partition assembly.

Edges of wallboard panels shall be butted loosely together. All cut edges and ends shall be smoothed as needed for neat fitting joints.

All edges and ends of gypsum wallboard panels shall coincide with the framing members, except those edges and ends which are perpendicular to the framing members. End joints on ceiling and on the opposite sides of a partition assembly shall be staggered.

Except where closer spacings are shown on the plans, the spacing of fasteners shall not exceed the following:

Nails	175 mm
Screws	300 mm

Nails or Type W steel drill screws shall be used to fasten wallboard to wood framing.

Adhesives shall not be used for securing wallboard to framing.

Gypsum wallboard panels shall be fastened to all framing members except at the following locations:

At internal angles formed by ceiling and walls; ceiling panels shall be installed first with the fasteners terminating at a row 175 mm from the walls, except for walls parallel to ceiling framing. Wall panels shall butt the ceiling panels. The top row of wall panel fasteners shall terminate 200 mm from the ceiling.

At internal vertical angles formed by the walls; fasteners shall not be installed along the edge or end of the panel that is installed first. Fasteners shall be installed only along the edge or end of the panel that butts and overlaps the panel installed first.

Fasteners shall be located at least 10 mm from wallboard panel edges and ends. Nails shall penetrate into wood framing at least 30 mm. Screws shall penetrate into wood framing at least 20 mm. All metal fasteners shall be driven slightly below surface level without breaking the paper or fracturing the core.

Metal trim shall be installed at all free edges of panels, at locations where wallboard panels abut dissimilar materials and at locations shown on the plans. Corner beads shall be installed at external corners. Control joints shall be installed at the locations shown on the plans.

Joints between face panels, the internal angles formed by ceiling and walls and the internal vertical angles formed by walls shall be filled and finished with joint tape and at least 3 coats of joint compound. Tape in the corners shall be folded to conform to the angle of the corner. Tape at joints and corners shall be embedded in joint compound.

Dimples at nail and screw heads, dents, and voids or surface irregularities shall be patched with joint compound. Each patch shall consist of at least 3 coats and each coat shall be applied in a different direction.

Flanges of corner beads, control joints and trim shall be finished with a least 3 coats of joint compound.

Each coat of joint compound shall be feathered out onto the panel surface and shall be dry and lightly sanded before applying the next coat. The finished surfaces of joint compound at the panel joints, internal angles, patches and at the flanges of trim, corner beads and control joints shall be flat and true to the plane of the surrounding surfaces and shall be lightly sanded.

Good lighting of the work area shall be provided during the final application and sanding of the joint compound.

Surfaces of wallboard to be textured shall receive an orange peel texture, unless otherwise shown on the plans.

12-9.02 PORCELAIN CERAMIC TILE

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing porcelain ceramic tile in accordance with the details shown on the plans and these special provisions.

Ceramic tile shall include unglazed matte porcelain floor tile, setting materials, grouts and such other materials as maybe required for a complete installation.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data, a list of materials to be used, and installation instructions for all materials required for the work shall be submitted for approval.

Manufacturer's descriptive data shall be submitted for each type of tile, mortar bed materials, bond coat materials and additives, and grout materials and additives.

Materials list and installation instructions shall include all products and materials to be incorporated into the work.

Friction reports shall be submitted for tile products to be used on floors and other pedestrian surfaces.

Samples.--Samples shall include 2 individual samples of each type and color of tile to be installed and shall be of the same size, shape, pattern and finish as the tile to be installed.

QUALITY ASSURANCE.--

Single source responsibility.--Each type and color of tile, grout and setting materials shall be obtained from a single source.

Master Grade Certificates.--Each shipment of tile to the project site shall be accompanied by a Master Grade Certificate issued by the tile manufacturer.

Certificates of Compliance.--Certificates of Compliance shall be furnished for bond coat materials, setting bed materials and grout in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

DELIVERY, STORAGE AND HANDLING.--

Delivery.--Tile and packaged materials shall be delivered to the job site in sealed, unbroken, unopened containers with the labels intact. Tile containers shall bear the Standard Grade label.

Storage and handling.--Materials shall be stored and handled in such a manner as to prevent damage or contamination by water, freezing or foreign matter.

PROJECT CONDITIONS.--

Protection.--Tile work shall be protected and environmental conditions maintained during and after installation to comply with the reference standards and manufacturer's printed instructions.

Temperatures.--Unless otherwise specified in the manufacturer's installation instructions, the ambient temperature shall be maintained at not less than 10°C nor more than 38°C in tiled areas during installation and for 7 days after completion. Exterior work areas shall be shaded from direct sunlight during installation.

Tile shall not be installed when the temperature of the substrate is greater than 32°C or is frost covered.

Illumination.--Interior work areas shall be illuminated to provide the same level and angle of illumination as will be available during final inspection.

PART 2.- PRODUCTS

MANUFACTURERS.--

Available manufacture's.--Subject to compliance with the specifications, tile shall be American Olean Tile Co., Inc.; Summitville Tiles, Inc.; United States Ceramic Tile Co.; or equal.

GENERAL.--

Ceramic tile.--Ceramic tile shall conform to the requirements in ANSI Standard: A137.1, "American National Standard Specifications for Ceramic Tile" for types and grades of tile indicated.

Ceramic tile shall conform to the "Standard Grade" requirements.

Tile installation materials.--Tile installation materials shall conform to the requirements in ANSI standard referenced with products and materials indicated for setting and grouting.

Tile color and size.--Tile color shall be as shown on the plans.

Slip resistant tile.--Slip resistant tile shall have sufficient abrasives added such that the static coefficient of friction, wet or dry, shall be not less than 0.6 for walking surfaces and 0.8 for ramps when tested in accordance with ASTM Designation: C 1028.

TILE PRODUCTS.--

Unglazed matte porcelain tile.--

Unglazed matte porcelain tile shall be machine made, unpolished, dust pressed natural porcelain clay and shall have a plain face. Tile shall have a nominal thickness of 8 mm. Matte porcelain tile shall be slip resistant.

Unglazed matte porcelain trim tile shall include cove type base at walls and single piece intersecting cove base at corners.

SETTING MATERIALS.--

Portland cement mortar installation materials.--

Materials for portland cement mortar installation shall conform to the requirements in ANSI Standard: A108.1 as required for installation method designated, unless otherwise indicated.

Membrane.--Membrane shall be asphalt impregnated felt conforming to ASTM Designation: D 226, Type I, or polyethylene film conforming to ASTM Designation: C 171, Type 1.1.2. Polyethylene film shall not be less than 0.1 mm thick.

Reinforcement.--Reinforcement shall be galvanized welded wire fabric with 50 mm x 50 mm - 1.6 mm x 1.6 mm conforming to ASTM Designations: A 82 and A 185 except for minimum wire size. Reinforcement shall be provided in flat sheets.

Metal lath.--Metal lath shall be self furring, galvanized, conforming to ASTM Designation: C 847, flat expanded type weighing not less than 1.4 kg/m^2. Factory assembled metal lath and paper backing may be used where reinforcement over paper is shown on the plans.

Tile bond coat.--

Tile bond coat shall be latex-portland cement bond coat.

Latex-portland cement mortar bond coat shall be a prepackaged mortar mix, conforming to ANSI Standard: A118.4, incorporating a dry acrylic resin, and to which only water is added at the job site. Mortar shall be suitable for exterior use and be labeled for the type of tile to be installed.

Epoxy bond coat.--

Epoxy bond coat shall be a 2 part prepackaged epoxy mortar conforming to ANSI Standard: A118.3, suitable for exterior use. Mortar shall be labeled for the type of tile to be installed.

GROUTING MATERIALS.--

Tile grout.--

Tile grout shall be latex-portland cement grout.

Latex-portland cement grout shall be a prepackaged grout mix, conforming to ANSI Standard: A118.6, incorporating a dry acrylic resin, and to which only water is added at the jobsite. Grout shall be suitable for exterior use and labeled for the type of tile to be installed.

Epoxy grout.--

Epoxy grout shall be a 2 part prepackaged epoxy grout conforming to ANSI Standard: A118.3 and suitable for exterior use. Grout shall be labeled for the type of tile to be used.

Grout pigment.--

Grout pigment shall be chemically inert, fade resistant mineral oxide or synthetic type. Color shall be as shown on the plans.

SEALANTS.--

Sealant.--

Sealant for vertical expansion joints shall be a medium modulus silicone or polyurethane. Sealant for horizontal joints shall be a 2-part polyurethane type material with a Shore Hardness of 35 to 45.

Color of exposed sealants shall match color of grout in tile adjoining sealed joints.

MORTAR BEDS.--

Cement mortar bed.--

Cement mortar bed for floors shall be proportioned of one part cement, 1/10 parts hydrated lime, 5 parts damp sand by volume and only enough water added to provide the necessary workability. Ingredients shall be dry mixed, water added, and materials blended to produce a stiff mix. Mortar bed shall be not less than 32 mm in thickness.

MISCELLANEOUS MATERIALS.--

Sand.--

Sand shall be a natural or manufactured sand conforming to ASTM Designation: C 144, except that no more than 10 percent shall pass the No. 150 µm sieve.

Sealers.--

Sealer for unglazed quarry tile shall be water repellent, clear solution of ammonium cementitious compound, silicone base material, or other commercially manufactured sealer.

Sealer for grout shall be a penetrating proprietary compound designed for sealing grout. Silicone sealers shall not be used.

Cement.--

Cement shall conform to ASTM Designation: C 150, Type I.

Hydrated lime.--

Hydrated lime shall conform to ASTM Designation: C 206, Type S, or ASTM Designation: C 207, Type S.

Water.--

Water shall be clean and potable.

Metal edge strips.--

Metal edge strips shall be stainless steel terrazzo strips, 3 mm wide at top edge with integral provision for anchorage to mortar bed or substrate.

MIXING MORTAR AND GROUT.--

Mixing.--Mortar and grout shall be mixed to comply with the requirements of referenced standards and manufacturers for accurately proportioning of materials, water or additive content, mixing equipment and mixer speeds, mixing containers, mixing time, and other procedures need to produce mortars and grout of uniform quality with optimum performance characteristics for application intended.

PART 3.- EXECUTION

PREPARATION.--

General.--Surfaces to receive a mortar setting bed or a bond coat shall be cleaned adequately to assure a tight bond to the applied material. Such cleaning shall leave the surface thoroughly roughened and free from laitance, coatings, oil, sand, dust and loose particles.

The cleaned surfaces which are to receive a mortar bed shall be saturated with water just prior to placing mortar or the cleaned surfaces shall be coated with fresh neat cement slurry. If the surface is saturated with water, excess water shall be removed and the wetted surfaces uniformly dusted with portland cement. The slurry or wetted cement dust shall be broomed to completely coat the surface with a thin and uniform coating just prior to placing the mortar.

Substrates shall be inspected to insure that grounds, anchors, plugs, recessed frames, bucks, drains, electrical work, mechanical work, and similar items in or behind the tile have been installed before proceeding with installation of the tiles.

INSTALLATION.--

General.--Tile installation shall conform to applicable parts of ANSI 108 Series of the tile installation standards included under "American National Standard Specifications for the Installation of Ceramic Tile" and Tile Council of American, "Handbook for Ceramic Tile Installation."

All tile shall be installed on a bond coat over a setting bed. The setting bed shall be a cured cement mortar bed or a prepared, dimensionally stable substrate of concrete, masonry, cementitious backer board, or other cementitious material.

The back face of the tile shall be free of paper, adhesives, fiber mesh, resins, or other materials affecting the bond of the tile to the bedding material.

Tile sheets shall have permanent edge bonding or temporary mounting materials on the exposed face. Water soluble or absorbent adhesives shall not be used for edge bonding. Temporary mounting materials shall allow observation during tile setting operations.

Tile work shall extend into recesses and under or behind equipment and fixtures, to form a complete covering without interruptions, except as shown on the plans. Work shall be terminated neatly at obstructions, edges and corners without disrupting pattern or joint alignments.

Intersections and returns shall be accurately formed. Cutting and drilling of tile shall be performed without marring visible surfaces. Cut edges of tile abutting trim, finish or built-in items shall be carefully ground to produce straight aligned joints. Tile shall be closely fit to electrical outlets, piping, fixtures and other penetrations such that plates, collars, or covers overlap the tile.

Mortar bed placement.--The mortar bed, with or without reinforcement as shown on the plans, shall be placed, consolidated, and finished to the required thickness.

The surface of the mortar bed shall be true and pitched as shown on the plans, without high or low spots. The mortar bed surface shall not vary more than 3 mm in 2.4 m from a plane parallel to the finished tile surface when tile is installed on a cured mortar bed.

In no case shall the allowed tolerances result in offsets between adjoining tiles, low spots on finished tile surfaces than can pond water, or finished tile surfaces that are not plumb or not true.

Tile bond coat.--The tile bond coat mortar shall be mixed according to the manufacturer's recommendations. The consistency of the mixture shall be such that ridges formed with the recommended notched trowel shall not flow or slump. Reworking will be allowed provided no water or materials are added. The setting bed surfaces shall be dampened before placing the bond coat as necessary tile installation, but the setting bed shall not be soaked. The setting bed surfaces for epoxy bond coat shall be dry.

The bond coat shall be floated onto the cured mortar bed surface with sufficient pressure to cover the surface evenly with no bare spots. The surface area to be covered with the bond coat shall be no greater than the area that can be tiled while the bond coat is still plastic. The bond coat shall be combed with a notched trowel as recommended by the manufacturer within 10 minutes before installing tile. Tile shall not be installed on a skinned over bond coat.

Installing tiles.--Tile shall be installed in accordance with the manufacturer's instructions and shall be set solid and shall be well bonded to the substrate.

Tile set on a tile bond coat shall be installed in accordance with ANSI Standard: A108.5, and tile set on an epoxy mortar shall be installed in accordance with ANSI Standard: A108.6.

If tiles are cut, the cuts shall be made with saws. Cut edges shall be rubbed with an abrasive stone to bring the edge of the glaze slightly back from the body of the tile. Cuts shall be accurately made to neatly fit the tile in place. Cut edges shall not be butted against other tile. Cut tile shall be at least half the size of a full size tile.

Tile shall completely cover wall areas behind mirrors and fixtures.

Tile shall be installed so that the finished tile surface does not vary more than 3 mm in 2.4 m from the finished tile surface shown on the plans. In no case shall there be offsets in adjoining tiles, low spots on finished tile surfaces that can pond water, or finished tile surfaces that are not plumb or true in the completed tile work.

Tiles shall be firmly pressed into the freshly notched bond coat. Tile on interior surfaces shall be tapped and beat into a true surface and to obtain at least 80 percent coverage by the mortar on the back of each tile. Tile on exterior surfaces shall have 100 percent coverage and shall be back-buttered immediately prior to setting the tile.

Mortar that exudes into the grout spaces between tiles shall be removed to the bottom of tile.

Joints.--Joints between tile shall be continuous both vertically and horizontally. Joints shall be straight and of uniform and equal width. Where tiles on adjoining surface are the same size, the joints shall align, one with the other. Joint width shall be as recommended by the tile manufacturer.

Grouting tile.--Grout shall be mixed, applied and cured in accordance with the manufacturer's recommendations and ANSI Standard: A108.10 for cement grout and ANSI Standard: A108.9 for epoxy grout.

Spacers, strings, ropes, pegs, glue, paper, and face mounting material shall be removed before grouting. Joints between glazed wall tile shall be wetted if they have become dry. Joints for epoxy mortar shall be dry.

Grouting shall not begin until at least 48 hours after installing tile.

A maximum amount of grout shall be forced into the joints between tiles in accordance with the manufacturer's recommendations. The grout shall be finished to the depth of the cushion for cushion edge tile and finished flush with the surface for square edge tile. All gaps and skips in the grout spaces shall be filled.

Mortar or mounting mesh shall not show through the grouted joints.

The finished grout shall have a uniform color and shall be smooth without voids, pinholes or low spots.

Expansion joints shall be kept free of grout or mortar.

Grout shall be protected from freezing or frost for a least 5 days after installation.

Expansion joints.--Expansion joints shall be installed at the perimeter of all tile floors and at all substrate control joints and changes in the substrate material. Exterior expansion joint spacing shall not exceed 5 m in any direction.

All expansion joints shall be made with sealant over backer rods. The thickness of sealant at the center of expansion joints shall not exceed the width of the joint. Joint edges shall be primed as recommended by the sealant manufacturer.

Edge strips.--Edge strips shall be installed at openings where the threshold has not been shown on the plans, but where tile floor abuts other flooring materials at the same level. Edge strips shall be installed centered under the closed door, or where there is no door, centered in the opening.

Sounding tile.--Tiled surfaces shall be sounded with a metal bar or chain for improperly bonded tile or setting bed. Tile or setting bed that emits a hollow sound shall be replaced.

Replacement.--Cracked, chipped, broken, or otherwise defective tiles shall be removed and replaced. All tiles which differ more than 2 mm in elevation from adjacent tile edges shall be removed and replaced.

Curing.--After the installation of tile and the grouting of joints, the tile and grout shall be cured by keeping the surface continuously damp for at least 72 hours after grouting. Curing materials shall not stain the tile or grouted joints. Curing methods shall not erode away the grout.

After grouting, horizontal tiled surfaces shall be closed to traffic, and all tiled surfaces shall be kept free from impact, vibration or shock, for at least 72 hours.

CLEANING AND PROTECTION.--

Cleaning tile surfaces.--All exposed tile surfaces shall be cleaned of all grout haze upon completion of grouting. Acids and chemicals used to clean tile shall conform to the tile manufacturer's recommendations. Cleaners shall not be harmful to materials on surfaces of abutting floors, walls, and ceilings. Tile work shall be rinsed thoroughly with clean water before and after using acid or chemical cleaners. After cleaning and rinsing, tile surfaces shall be polished using a soft cloth.

Tile work shall be cleaned and polished again immediately prior to completion of the contract. All dirt, grime, stains, paints, grease, and other discoloring agents or foreign materials shall be removed.

Protection.--After grouting, horizontal tiled surfaces shall be closed to traffic, and all tiled surfaces shall be kept free from impact, vibration or shock, for at least 72 hours after.

Tile surfaces damaged by construction operations shall be retiled.

SCHEDULES.--

Floor tile.--

Floor tile shall be nominal 51 mm x 51 mm unglazed matte porcelain tile installed on a mortar bed using a tile bond coat and grout and shall conform to the requirements of Method F 112, "Handbook for Ceramic Tile Installation."

12-9.03 RUBBER BASE

GENERAL.--This work shall consist of furnishing and installing rubber base in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--Manufacturer's descriptive data, installation instructions, color palette, and samples of rubber base shall be submitted for approval. Samples shall be not less than 50 mm in length.

PRODUCTS.--

Rubber base.--

Resilient base shall be manufacturer's best grade, rubber with premolded internal and external corner pieces. The height and color shall be as shown on the plans.

Adhesive.--

Adhesive shall be as recommended by base manufacturer.

EXECUTION.--

INSTALLATION.--Bases shall be firmly and totally attached to walls with adhesive and shall be accurately scribed to trim, molding and cabinets. All joints shall be tight fitting. Bases between premolded corners or other termini may be installed continuous or installed using one m minimum standard manufactured lengths. Filler pieces shall be not less than 0.5 m.

12-9.04 VINYL COMPOSITION TILE

GENERAL.--This work shall consist of furnishing and installing vinyl composition tile in accordance with the details shown on the plans and these special provisions.

Vinyl composition tile shall consist of vinyl composition tile, edger strips, floor wax and tile manufacturer's recommended primers and adhesives.

SUBMITTALS.--Manufacturer's descriptive data, installation instructions, color and pattern samples shall be submitted for approval. Samples of tile shall be 305 mm x 305 mm in size.

PRODUCTS.--

Vinyl composition tile.--

Vinyl composition tile shall be semi-flexible, 2.38 mm minimum thick, 305 mm x 305 mm tile conforming to Federal Specification: SS-T-312, Type IV. Color and pattern shall be as shown on the plans.

Primer, leveling compound crack filler and adhesives.--

Primer, leveling compound crack filler and adhesives shall be waterproof types as recommended by the tile manufacturer.

Wax.--

Wax shall be water emulsion, self-polishing type containing not less than 16 percent wax solids, wetting agents, and a nonslip agent. The wax shall meet UL antislip standards.

Edger strips.--Edger strips shall be commercial quality, stainless steel or aluminum.

EXECUTION.--

PREPARATION.--Before placing adhesives, all surfaces to receive vinyl composition tile shall be made free of localized depressions or bumps. Bumps shall be ground flat. Holes, depressions and cracks shall be filled with crack filler or leveling compound.

Immediately prior to application of the tile flooring, the surface to be covered shall be thoroughly dry, free of paint, oil, grease, mortar, plaster droppings, scaly surfaces or other irregularities and shall be broom clean. Primer, when recommended, shall be thoroughly brushed on the surface at the rate recommended by the adhesive manufacturer and shall be completely dry before the application of adhesives.

The rooms where tile is to be installed shall be maintained at a temperature of at least 21°C for not less than 72 hours before installation, during installation and for 5 days after installation.

APPLICATION.--Tile shall be laid to a true, straight, smooth and even finished surface in accordance with the manufacturer's instructions. Joints shall be tight fitting. Floor covering shall be placed before floor mounted fixtures are installed. After tile has been set, the finished surface shall be rolled and crossrolled with a roller weighing 50 kg or more.

Edger strips shall be installed at free edges.

Where tile patterns between rooms differ, the pattern break at openings shall occur at the centerline of the common wall.

Upon completion of the tile application, all stains, surplus adhesive, dirt and debris resulting from the work shall be removed and the floor left broom clean. Tile shall be protected from damage at all times during construction. As a last order of work, tile shall be washed with soap and warm water, rinsed, and then waxed in accordance with the tile manufacturer's printed instructions. Not less than 2 applications of wax shall be placed on the tile flooring.

12-9.05 RESILIENT SHEET FLOORING

GENERAL.--This work shall consist of furnishing and installing resilient sheet flooring in accordance with the details shown on the plans and these special provisions.

Resilient sheet flooring shall also include cove molding, metal caps, edger strips, floor wax and flooring manufacturer's recommended primers and adhesives.

SUBMITTALS.--Manufacturer's descriptive data, installation instructions, color and pattern samples shall be submitted for approval. Samples of sheet flooring shall be 305 mm x 305 mm in size.

PRODUCTS.--

Resilient sheet flooring.--

Resilient sheet flooring shall be flexible vinyl sheet not less than 2 mm thick. Color and pattern shall be as shown on the plans.

Primer, leveling compound crack filler and adhesives.--

Primer, leveling compound crack filler and adhesives shall be waterproof types as recommended by the flooring manufacturer.

Wax.--

Wax shall be water emulsion, self-polishing type containing not less than 16 percent wax solids, wetting agents, and a nonslip agent. The wax shall meet UL antislip standards.

Cove molding.--

Cove molding shall be commercial quality wood, rubber or plastic.

Edger strips.--

Edger strips shall be commercial quality, stainless steel or aluminum.

Metal caps.--

Metal caps shall be commercial quality, noncorrosive metal.

EXECUTION.--

PREPARATION.--Before placing adhesives, all surfaces to receive resilient sheet flooring shall be made free of localized depressions or bumps. Bumps shall be ground flat. Holes, depressions and cracks shall be filled with crack filler or leveling compound.

Immediately prior to installation of the resilient sheet flooring, the surface to be covered shall be thoroughly dry, free of paint, oil, grease, mortar, plaster droppings, scaly surfaces or other irregularities and shall be broom clean. Primer, when recommended, shall be thoroughly brushed on the surface at the rate recommended by the adhesive manufacturer and shall be completely dry before application of adhesives.

The rooms where resilient sheet flooring is to be installed shall be maintained at a temperature of at least 21°C for not less than 72 hours before installation, during installation and for 5 days after installation.

INSTALLATION.--Resilient sheet flooring shall be laid to a true, straight, smooth and even finish surface in accordance with the manufacturer's instructions. Resilient sheet flooring shall be laid parallel to building lines with the minimum of seams using manufacturer's standard widths. Seams shall be tight fitting, fully bonded along their length and present a continuous pattern.

Resilient sheet flooring shall be placed before floor mounted fixtures are installed.

After resilient sheet flooring has been installed, the finished surface shall be rolled and crossrolled with a roller weighing 50 kg or more.

Edger strips shall be installed at free edges.

Upon completion of the flooring installation, all stains, surplus adhesive, dirt and debris resulting from the work shall be removed and the floor left broom clean. Resilient sheet flooring shall be protected from damage at all times during construction. As a last order of work, floor covering shall be washed with soap and warm water, rinsed, and then waxed in accordance with the floor covering and wax manufacturers' printed instructions. Not less than 2 applications of wax shall be placed on the floor covering.

12-9.06 PAINTING

PART 1.- GENERAL

SUMMARY.--This work shall consist of preparing surfaces to receive coatings, and furnishing and applying coatings, in accordance with the schedules and details shown on the plans, and these special provisions.

The coatings specified in this section are in addition to any factory finishes, shop priming, or surface treatment specified elsewhere in these special provisions.

SUBMITTALS.--Manufacturer's descriptive data, a materials list, and color samples shall be submitted for approval.

Product descriptive data shall include product description, manufacturer's recommendations for product mixing, thinning, tinting, handling, site environmental requirements, product application and drying time.

Materials list shall include manufacturer's name, trade name, and product numbers for each type coating to be applied.

Color samples shall be manufacturer's color cards, approximately 50 mm x 75 mm, for each color of coating shown on the plans. Color samples for stains shall be submitted on wood of the same species, color, and texture as the wood to receive the stain.

REGULATORY REQUIREMENTS.--Coatings and applications shall conform to the rules for control of volatile organic compound emissions adopted by the air quality control district in the air basin in which the coatings are applied.

SITE ENVIRONMENTAL REQUIREMENTS.--Coatings shall not be applied when the air temperature is below 10°C (20°C for varnishes) or when the relative humidity exceeds 75 percent.

The surface to be coated shall be maintained at a minimum temperature of 7°C for a period of 24 hours prior to, and 48 hours after the application of the coating. Heating facilities shall be provided when necessary.

Continuous ventilation shall be provided during application of the coatings.

A minimum lighting level of 865 lux, measured 1 m from the surface to be coated, shall be provided while surfaces are being prepared for coatings and during coating applications.

DELIVERY, STORAGE, AND HANDLING.--Products shall be delivered to the site in sealed, labeled containers and stored in a well ventilated area at an ambient air temperature of not less than 7°C. Container labeling shall include manufacturer's name, type of coating, trade name, color designation, drying time, and instructions for tinting, mixing, and thinning.

MAINTENANCE STOCK.--Upon completion of coating work, a full 3.8 liter container of each type and color of finish coat and stain used shall be delivered to the location at the project site designated by the Engineer. Containers shall be tightly sealed and labeled with color, texture, and room locations where used, in addition to the manufacturer's standard product label.

PART 2.- PRODUCTS

GENERAL.--The products shall be the best quality grade coatings of the specified types as regularly manufactured by nationally recognized paint and varnish manufacturers that have not less than 10 years experience in manufacturing paints

and varnishes. Products that do not bear the manufacturer's identification as the best quality grade product shall not be used. Products for each coating system shall be by a single manufacturer and shall not contain lead type pigments.

Thinners, shellac, fillers, patching compounds, coloring tint, and other products required to achieve the specified finish shall be the manufacturer's best quality and shall be used as recommended.

PART 3.- EXECUTION

INSPECTION.--Surfaces to be coated at the jobsite shall be approved by the Engineer prior to the application of coatings. The Contractor shall notify the Engineer at least 3 working days prior to the application of coatings.

SURFACE PREPARATION.--Surfaces scheduled to be coated shall be prepared in accordance with the following, except that the surfaces not specified herein shall be prepared as recommended by the coating manufacturer.

GENERAL.--Hardware, cover plates, light fixture trim, and similar items shall be removed prior to preparing surfaces for coating. Following the application of the finish coating, the removed items shall be reinstalled in their original locations.

WOOD.--Oil and grease shall be removed by solvent wash. Mildew shall be removed by mildew wash. Surfaces to be coated shall be cleaned of all dirt, excess material, or filler by hand cleaning. Smooth surfaced wood shall be sanded lightly.

A sealer composed of equal parts of shellac and alcohol shall be spot applied to knots, sap, pitch, tar, creosote, and other bleeding substances.

After the application of the prime coat, all nail holes, cracks, open joints, dents, scars, and surface irregularities shall be filled, hand cleaned, and spot primed to provide smooth surfaces for the application of finish coats.

Irregularities in wood surfaces to receive a transparent stain finish shall be filled and hand cleaned after the first coat of stain has been applied. The color of the filler shall match the color of the stained wood.

Irregularities in wood surfaces to receive a clear finish shall be filled and hand cleaned before the application of coatings. The color of the filler shall match the color of the coated wood.

GALVANIZED METAL.--Oils, grease, and fabrication lubricants shall be removed by solvent wash. Surfaces shall be cleaned of remaining surface treatments by hand cleaning. New surfaces shall be roughened by hand cleaning or light abrasive blasting.

Abraded or corroded areas shall be hand cleaned and spot coated with one coat of vinyl wash pretreatment. Abraded or corroded areas on new surfaces not scheduled to be painted shall be cleaned by solvent wash, hand cleaned, and given 2 spot applications of zinc rich paint.

STEEL AND OTHER FERROUS METALS.--Oils, grease, and fabrication lubricants shall be removed by solvent wash. Dirt, water soluble chemicals, and similar surface contamination shall be removed by detergent wash or steam cleaning. Mill scale and rust shall be removed by hand cleaning or abrasive blasting.

ALUMINUM AND OTHER NON-FERROUS METALS.--Oils, grease, and fabrication lubricants shall be removed by solvent wash. Dirt, water soluble chemicals, and similar surface contamination shall be removed by detergent wash.

GYPSUM BOARD.--Holes, cracks, and other surface imperfections shall be filled with joint compound or suitable filler prior to application of coatings. Taped joints and filled areas shall be hand sanded to remove excess joint compound and filler.

DEFINITIONS.--

DETERGENT WASH.--Removal of dirt and water soluble chemicals by scrubbing with a solution of detergent and water, and removal of all solution and residues with clean water.

HAND CLEANING.--Removal of dirt, loose rust, mill scale, excess base material, filler, aluminum oxide, chalking paint, peeling paint, or paint which is not firmly bonded to the surfaces by using hand or powered wire brushes, hand scraping tools, power grinders, or sandpaper and removal of all loose particles and dust prior to coating.

MILDEW WASH.--Removal of mildew by scrubbing with a solution of detergent, hypochlorite-type household bleach, and warm water, and removal of all solution and residues with clean water.

ABRASIVE BLASTING.--Removal of oil, grease, form release agents, paint, dirt, rust, mill scale, efflorescence, weak concrete, or laitance, by the use of airborne abrasives, and removal of loose particles, dust, and abrasives by blasting with clean air.

Abrasives shall be limited to clean dry sand, mineral grit, steel grit, or steel shot, and shall be graded to produce satisfactory results. Unwashed beach sand containing salt or silt shall not be used.

Abrasive blasting shall conform to the requirements of SSPC-SP6-85, Commercial Blast Cleaning, as defined in the Steel Structures Painting Council Manual.

Light abrasive blasting shall conform to the requirements of SSPC-SP7-85, Brush-Off Blast Cleaning, as defined in the Steel Structures Painting Council Manual.

SOLVENT WASH.--Removal of oil, grease, wax, dirt, or other foreign matter by using solvents, such as mineral spirits or xylol, or other approved cleaning compounds.

STEAM CLEANING.--Removal of oil, grease, dirt, rust, scale, or other foreign matter by using steam generated by commercial steam cleaning equipment, from a solution of water and steam cleaning compounds, and removal of all residues and cleaning compounds with clean water.

TSP WASH.--Removal of oil, grease, dirt, paint gloss, and other foreign matter by scrubbing with a solution of trisodium phosphate and warm water, and removal of all solution and residues with clean water.

WATER BLASTING.--High pressure, low volume water stream for removing dirt, light scale, chalking or peeling paint. Water blasting equipment shall produce not less than a 13 800 MPa minimum output pressure when used. Heated water shall not exceed 66°C. If a detergent solution is used, it shall be biodegradable and shall be removed from all surfaces with clean water.

PROTECTION.--The Contractor shall provide protective devices, such as tarps, screens or covers, as necessary to prevent damage to the work and to other property or persons from all cleaning and painting operations.

Paint or paint stains on surfaces not designated to be painted shall be removed by the Contractor at his expense and the original surface restored to the satisfaction of the Engineer.

APPLICATION.--

GENERAL.--Coatings shall be applied in accordance with the printed instructions and at the application rates recommended by the manufacturer to achieve the dry film thickness specified in these special provisions.

Mixing, thinning and tinting shall conform to the manufacturer's printed instructions. Thinning will be allowed only when recommended by the manufacturer.

Coatings shall be applied only when surfaces are dry and properly prepared.

Cleaning and painting shall be scheduled so that dust and other contaminants from the cleaning process will not fall on wet, newly coated surfaces.

Materials required to be coated shall have coatings applied to all exposed surfaces, including the tops and bottoms of wood and metal doors, the insides of cabinets, and other surfaces not normally visible from eye level.

APPLICATION SURFACE FINISH.--Each coat shall be applied to a uniform finish. Finished surfaces shall be free of surface deviations and imperfections such as skips, cloudiness, spotting, holidays, laps, brush marks, runs, sags, curtains, ropiness, improper cutting in, overspray, drips, ridges, waves, and variations in color and texture.

Each application of a multiple application finish system shall closely resemble the final color coat, except each application shall provide enough contrast in shade to distinguish the separate applications.

WORK REQUIRED BETWEEN APPLICATIONS.--Each application of material shall be cured in accordance with the coating manufacturer's recommendations before applying the succeeding coating. Enamels and clear finishes shall be lightly sanded, dusted, and wiped clean between applications.

Stain blocking primer shall be spot applied whenever stains bleed through the previous application of a coating.

TIMING OF APPLICATIONS.--The first application of the specified coating system shall be applied prior to any deterioration of the newly prepared surface. Metal surfaces shall be prepared and prime coated the same day that cleaning of bare metal is performed. Additional prime coats shall be applied as soon as drying time of the preceding coat permits.

Metal surfaces shall be prime coated within 12 hours of application of vinyl wash pretreatment.

Shellac sealer shall be allowed to dry at least 12 hours before applying the next coat.

Drying time between applications of water borne coatings shall be at least 12 hours.

APPLICATION METHODS.--Coatings shall be applied by brush, roller or spray. Rollers shall be of a type which do not leave a stippled texture in the paint film. Extension handles for rollers shall not be greater than 2 m in length.

If spray methods are used, surface deviations and imperfections such as, overspray, thickness deviations, lap marks, and orange peel shall be considered as evidence that the work is unsatisfactory and the Contractor shall apply the remainder of the coating by brush or roller, as approved by the Engineer.

DRY FILM THICKNESS.--

Vinyl wash pretreatment	0.007 mm to 0.13 mm, maximum.
Bituminous paint	0.1 mm, minimum.
Epoxy polyamide primer	0.1 mm, minimum.
Aliphatic polyurethane enamel	0.05 mm, minimum.
Other primers, undercoats, sealers, and coatings	As recommended by the manufacturer.

BACKPRIMING.--The first application of the specified coating system shall be applied to all wood surfaces (face, back, edges, and ends) of wood materials that are not factory coated, immediately upon delivery to the project site, except surfaces of interior finish woodwork that adjoin concrete or masonry shall be coated with one application of alkyd exterior wood primer before installation.

When clear or stain type coatings are required on millwork, trim, or paneling, varnish, reduced 25 percent by mineral spirits, shall be used for coating the back faces.

All primed metal surfaces in contact with concrete or concrete block exterior walls shall be coated with a bituminous paint on those surfaces in contact with the wall.

FINISHING MECHANICAL AND ELECTRICAL COMPONENTS.--Shop primed mechanical and electrical components shall be finish coated in accordance with the coating system entitled, "Shop Primed Steel." Louvers, grilles, covers, and access panels on mechanical and electrical components shall be removed and coated separately.

Interior surfaces of air ducts which are visible through grilles or louvers shall be coated with one application of flat black enamel, to limit of the sight line.

Exposed conduit, piping, and other mechanical and electrical components visible in public areas shall be painted.

Both sides and all surfaces, including edges and back of wood mounting panels for electrical and telephone equipment shall be finish coated before installing equipment.

CLEANING.--Upon completion of all operations, the coated surfaces shall be thoroughly cleaned of dust, dirt, grease, or other unsightly materials or substances.

Surfaces marred or damaged as a result of the Contractor's operations shall be repaired, at his expense, to match the condition of the surfaces prior to the beginning of the Contractor's operations.

COATING SYSTEMS.--The surfaces to be coated shall be as shown on the plans and as specified elsewhere in these special provisions. When a coating system is not shown or specified for a surface to be finish coated, the coating system to be used shall be as specified for the substrate material. The number of applications specified for each coating system listed herein is a minimum. Additional coats shall be applied if necessary to obtain a uniform color, texture, appearance, or required dry film thickness.

SYSTEM 1- ALUMINUM AND OTHER NON-FERROUS METALS.--

1 pretreat coat: vinyl wash pretreatment
1 prime coat: aluminum primer
2 finish coats: acrylic, exterior enamel, semi-gloss

SYSTEM 2- GALVANIZED METAL.--

1 pretreat coat: vinyl wash pretreatment
1 prime coat: galvanized metal primer
2 finish coats: acrylic, exterior enamel, semi-gloss

SYSTEM 3- GYPSUM BOARD.--

1 prime coat: PVA wall sealer
2 finish coats: acrylic, interior enamel, semi-gloss

SYSTEM 4- PREVIOUSLY COATED EXTERIOR SURFACES.--

1 prime coat : alkyd exterior enamel undercoat
2 finish coats: acrylic, exterior enamel, semi-gloss

SYSTEM 5- SHOP PRIMED STEEL.--

1 prime coat : red oxide ferrous metal primer
2 finish coats: alkyd, exterior enamel, semi-gloss

SYSTEM 6- STEEL AND OTHER FERROUS METALS.--

2 prime coats: red oxide ferrous metal primer
2 finish coats: alkyd, exterior enamel, semi-gloss

SYSTEM 7- WOOD, PAINTED.--

1 prime coat: alkyd, exterior wood primer
2 finish coats: acrylic, exterior enamel, semi-gloss

COLOR SCHEDULE.--Colors shall be as shown on the plans.

12-9.07 FIBERGLASS REINFORCED PLASTIC PANELS

GENERAL.--This work shall consist of furnishing and installing fiberglass reinforced plastic (FRP) panels and trim molding in accordance with details shown on the plans and these special provisions.

SUBMITTALS.--Manufacturer's descriptive data, installation instructions, and finish options shall be submitted for approval.

Product descriptive data shall show the manufacturer's name and shall indicate conformance to these special provisions.

Installation instructions shall show the FRP panel manufacturer's recommended method of installation.

Finish options shall show the manufacturer's standard color palette for FRP panels and trim molding. Color shall be as shown on the plans.

PRODUCTS.--

FRP panel.--

FRP panel shall be Class I flame-spread, minimum nominal thickness of 2 mm; Marlite, Class A/I FRP; Kemlite, Fire-X Glasbord; or equal.

Trim molding.--

Trim molding shall be manufacturer's standard vinyl molding with nailing flanges and a 9 mm deep channel of sufficient width to receive panels and sealant.

Adhesive and sealant.--

Adhesive and sealant shall be as recommended by the FRP panel manufacturer.

EXECUTION.--

INSTALLATION.--The FRP panels and trim molding shall be installed in accordance with the manufacturer's installation instructions.

Trim molding shall be nailed through the flange into solid wood backing. All nails shall be concealed by FRP panels in the completed installation. Trim shall be one continuous piece along each wall unless the wall length exceeds the manufacturer's standard trim length. If more than one piece is used on one wall, the pieces shall be approximately equal length, with no piece less than 1 m in length. All FRP panel edges shall be covered by a trim molding.

Panels shall be one continuous piece along each wall unless the wall length exceeds the manufacturer's standard panel length. If more than one panel piece is used on one wall, the pieces shall be approximately equal length, with no piece less than one meter in length.

CLEAN-UP.--Adjacent surfaces shall be protected from adhesive or sealant. Excess adhesive and sealant shall be removed as the installation progresses using a solvent or cleaning agent recommended by the FRP panel manufacturer.

SECTION 12-10. SPECIALTIES

12-10.01 TACKBOARDS

GENERAL.--This work shall consist of furnishing and installing tackboards in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--Manufacturer's descriptive data, color and texture samples and installation instructions shall be submitted for approval.

PRODUCTS.--

Tackboards.--

Tackboards shall be textured plastic coating on cotton-fabric, pressure laminated to 6 mm thick cork underlayment. Cork underlayment shall be bonded to a 6 mm thick hardboard backing. Tackboard dimensions shall be 1830 mm x 1220 mm.

Border moldings.--

Border moldings shall be factory applied, extruded clear anodized aluminum trim.

EXECUTION.--

INSTALLATION.--Tackboards shall be installed rigidly, securely, plumb and true, and in accordance with the manufacturer's recommendations.

12-10.02 MARKER BOARDS

GENERAL.--This work shall consist of furnishing and installing a marker boards in accordance with the details shown on the plans and these special provisions.

One felt eraser and 12 felt tipped liquid chalk markers of assorted colors shall be furnished for each marker board installed.

SUBMITTALS.--Manufacturer's descriptive data and installation instructions shall be submitted for approval.

PRODUCTS.--

Marker board.--

Marker board shall conform to Porcelain Enamel Institute Standard PEI-S-104, and shall be porcelain enamel surface on 0.61 mm thick (24-gage) sheet steel pressure laminated to 6 mm thick tempered hardboard. Hardboard

shall have a backing of 0.38 mm nominal thickness aluminum sheet. Enamel surface shall be suitable for marking with felt tipped liquid chalk markers and erasing with a felt eraser or dry cloth. The enamel surface shall be white in color.

Marker board dimensions shall be 1830 mm x 1220 mm.

Trim and marker tray.--

Trim and marker tray shall be factory installed, satin finish, clear anodized aluminum extrusions.

EXECUTION.--

INSTALLATION.--Marker boards shall be installed rigidly, securely, plumb and true in accordance with the manufacturer's instructions.

12-10.03 METAL TOILET PARTITIONS

GENERAL.--This work shall consist of furnishing and installing metal toilet partitions in accordance with the details shown on the plans and these special provisions.

Metal toilet partitions shall consist of panels, doors, pilasters, urinal screens, fasteners, anchorages and hardware. Internal reinforcement shall be provided at all fasteners, anchorages, hardware and accessories.

Doors, panels, pilasters, and urinal screens shall have a factory applied, baked on enamel finish consisting of not less than one prime coat over a chemically pretreated base followed by at least one baked on enamel finish coat.

SUBMITTALS.--Manufacturer's descriptive data, standard color palette, installation instructions and working drawings shall be submitted for approval.

Working drawings shall show the plan layout, door and panel elevations and all details required for the complete installation and anchorage of the partition system.

PRODUCTS.--

Doors and panels.--

Doors and panels shall be flush, 25 mm minimum thickness, formed of two 0.86 mm (22-gage) minimum thickness, galvanized steel sheets over a honeycomb core. Doors and panels shall have formed edges sealed with a continuous oval crown locking strip, and shall be mitered, welded and finished at the corners.

Doors shall have controlled action hinges, with vertical pintle and ball bearing roller operating on adjustable cams, or moving parts of nylon and stainless steel. Top pivots shall be recessed into edges of doors.

Doors shall be provided with slide bar latch and a combination coat-hat hook and door stop, except as otherwise specified.

Doors on stalls designed for use by the disabled shall be provided with a grip and turn latch, combination coat-hat hook and door stop, and U-shaped door pulls immediately below the latch on the inside and outside of the door.

Pilasters.--

Pilasters shall be 32 mm thick, of the same construction as the doors and panels, except the galvanized face sheets shall be 1.0 mm (20-gage) minimum thickness, and shall have an adjustable, leveling base.

Urinal screens.--

Urinal screens shall be wall-mounted, and of the same construction as the doors and panels, except face sheets shall be 1.0 mm (20-gage) minimum thickness. All fasteners shall be concealed.

Fasteners and anchorages.--

Fasteners and anchorages shall be stainless steel with vandal resistant heads.

Hardware.--

Hardware shall be highly polished chromium plated, cast alloy, or heavy duty anodized aluminum.

Pilasters anchors.--

Pilasters anchors shall be integral stud anchor type or internally threaded expansion sleeve type with single cone expander. Self-drilling type anchorage shall not be used.

Pilaster shoes.--

Pilaster shoes shall be one-piece, stainless steel, with concealed hold down clips, and of sufficient height to completely cover the base and anchors.

EXECUTION.--

INSTALLATION.--Metal toilet partitions shall be installed rigidly, securely, plumb, and true and in accordance with the manufacturer's recommendations. Tops and bottoms of doors shall align with tops and bottoms of panels, and all horizontal lines shall be level.

Rigid backing shall be provided in walls to receive anchorages.

Panels shall be anchored with at least 3 brackets at each wall and pilaster. Two anchors shall be used to fasten each pilaster base to the floor.

Doors shall not bind during opening and closing. The clearance between the door edges and pilasters shall be uniform, equidistant, and shall not exceed 5 mm. Hinges shall be adjusted to hold doors ajar when unlatched. Doors on stalls designed for use by the disabled shall return to the closed position.

Drilling, cutting and fitting of wall and floor finishes shall be concealed by the completed installation.

CLEAN-UP.--Toilet partitions shall be cleaned, polished and free of all defects. Chipped, dented, scratched, or otherwise damaged work shall be replaced at the Contractor's expense.

12-10.04 LOUVERS

GENERAL.--This work consists of furnishing and installing louvers in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--Manufacturer's descriptive data and installation instructions shall be submitted for approval.

PRODUCTS.--

Louvers.--

Louvers shall be factory fabricated units of extruded aluminum alloy not less than 2 mm thick (12-gage) or galvanized steel sheet not less than 1.63 mm thick (16-gage) with standard "Z" type blades, and removable bronze 16 x 16 mesh insect screens mounted on the inside of the units.

Louvers shall have integral caulking strips and retaining beads.

The finish on louvers shall be baked on primer and fluorocarbon polymeric resin.

EXECUTION.--

INSTALLATION.--Louvers shall be installed in accordance with the manufacturer's instructions. The completed louver installation shall be weather tight.

12-10.05 BLOCK VENTS

GENERAL.--This work consists of furnishing and installing louvered block vents in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--Manufacturer's descriptive data and installation instructions shall be submitted for approval.

PRODUCTS.--

Block vents.--

Block vents shall be louvered, load bearing, factory fabricated units of extruded aluminum sections, 6063-T5 alloy, not less than 3.2 mm thick, with sliding register and metal insect screens.

Front operated ventilating bolt control concealed by louvers, shall allow the sliding register to be fastened in an open or closed position.

Unit shall be McKinley, Construction Specialties, Inc., or equal.

The finish on louvers shall be anodized with the color as shown on the plans.

EXECUTION.--

INSTALLATION.--Louvered block vents shall be installed in accordance with the manufacturer's instructions. The completed installation shall be weather tight.

PAINTING.--Block vents shall be cleaned, prepared and painted in accordance with the requirements specified for aluminum and other non-ferrous metal under "Painting," in Section 12-9, "Finishes," of these special provisions.

12-10.06 SIGNS

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing signs in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data for sign materials, colors and graphics, and for fastening hardware and material shall be submitted for approval.

PART 2.- PRODUCTS

Plastic signs (permanent room identification).--

Plastic signs for permanent room identification for other than restrooms shall be scratch resistant, non-static, fire retardent, washable melamine laminate with a non-glare surface, not less than 3 mm thick. Letters and numbers shall be upper case Helvetica, 25 mm in height, 0.80 mm above and integral with sign material, accompanied by Grade 2 Braille.

Grade 2 Braille dots shall be 2.5 mm on centers in each cell with 5 mm space between cells. Dots shall be raised a minimum of 0.6 mm above the background.

Plastic sign (restroom).--

Plastic sign for restroom shall be not less than 6 mm acrylic plastic. Sign background shall be blue and shall conform to Federal Standard 595B, Color No. 15090. Male/female symbol and lettering shall be white and shall conform to Federal Standard 595B, Color No. 17886.

Male restroom identification shall be a male symbol on an equilateral triangle with edges 305 mm long and a vertex pointing upward.

Female restroom identification shall be a female symbol on a 305 mm diameter circle.

Unisex restroom identification shall be a male and female symbol on a 305 mm equilateral triangle superimposed on a 305 mm diameter circle.

Accessible building entrance sign.--

Accessible building entrance sign shall be not less than 3 mm acrylic plastic, not less than 102 mm x 102 mm, with the international symbol of accessibility.

Sign background shall be blue and shall conform to Federal Standard 595B, Color No. 15090. Symbol and border shall be white and shall conform to Federal Standard 595B, Color No. 17886.

Fastening hardware and material.--

Fastening hardware and material shall be as recommended by the sign manufacturer. Fasteners shall be noncorrosive.

PART 3.- EXECUTION

Inscription.--Sign messages shall be as shown on the plans.

Installation.--Plastic signs for room identification and restrooms shall be fastened or secured to clean, finished surfaces in accordance with the sign manufacturer's instructions. Signs shall be installed at a location and height as shown on the plans.

Metal signs shall be attached securely with galvanized or cadmium plated fasteners.

Fastening hardware and material shall be installed within the sign as shown on the plans.

12-10.07 WARDROBE LOCKERS

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing wardrobe lockers in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data, installation instructions, and standard color palette shall be submitted for approval.

PART 2.- PRODUCTS

ACCEPTABLE MANUFACTURERS.--

Available manufacturers.--Subject to conformance with the contract provisions, metal lockers shall be Art Metal Products; Interior Steel Equipment Co.; Republic Storage Systems; or equal.

Lockers.--

Lockers shall be standard, factory fabricated steel units. Framing shall be 1.52 mm thick (16-gage) and face sheets shall be 0.61 mm (24-gage), except door face sheets shall be 1.5 mm (16-gage).

Lockers shall be equipped with the following: hat shelf located approximately 255 mm below the top of the wardrobe locker, side to side coat rod, coat hook, louver vents at top and bottom of door, nonbreakable handle with provisions for a padlock, lockbar with 3-point latching contact with door frame and 1 1/2 pair full looped leaf hinges.

The approximate dimensions of the wardrobe lockers shall be 380 mm wide, 457 mm deep and 1829 mm high.

Base.--

Base shall be the manufacturer's standard continuous 16-gage, 152 mm channel base, fabricated of the same material and designed for use with the lockers provided. Base shall be set 13 mm off the face of the cabinet. Bases shall have the same finish as the locker units.

Top.--

Top shall be the manufacturer's standard continuous sloping top with end closure as needed, fabricated of the same material and designed for use with the lockers provided. Tops shall have the same finish as the locker units.

FABRICATION.--

Shop assembly.--Lockers shall be fabricated square, rigid, and without warp, with metal faces flat and free of dents or distortion.

Frame joints and seams shall be welded. Exposed welds shall be ground smooth. Hinge and latch connections shall be welded or riveted.

Bolts shall be used for assembly and mounting lockers components. Bolt or rivet heads on fronts of locker doors or frame shall not be exposed.

Factory finish.--Lockers shall be chemically pretreated with degreasing and phosphatizing process. Wardrobe lockers shall have a baked enamel finish on all surfaces, exposed and concealed.

PART 3.- EXECUTION

Installation.--Lockers shall be mounted on closed bases at locations shown in accordance with the manufacturer's instructions for plumb, level, rigid, and flush installation.

Wardrobe lockers shall be bolted together at tops and bottoms. The backs of the end lockers shall be bolted to wall anchors with 6 mm bolts installed near the tops of the wardrobe lockers as recommended by the locker manufacturer.

Trim, sloping tops, and metal filler panels, if required, shall be installed using concealed fasteners to provide flush, hairline joints against adjacent surfaces.

The number of lockers shall be as shown on the plans.

12-10.08 WOOD BENCHES

GENERAL.--This work shall consist of furnishing and installing wood benches in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--Manufacturer's descriptive data and installation instructions shall be submitted for approval.

PRODUCTS.--

Acceptable manufacturer's.--Subject to compliance with these requirements, manufacturer's shall be Penco Products, Inc.; Republic Storage Systems, Inc.; Interior Steel Equipment Co.; or equal.

Seat.--

Seat shall be factory fabricated, laminated seat units of solid birch or other suitable, dense hardwood and manufacturer's standard clear coating. Seat units shall be approximately 240 mm wide by 32 mm thick, by 914 mm long. Edges of the seat shall be rounded and all surfaces shall be smooth and free of splinters which would snag clothing or skin.

Supports assemblies.--

Supports assemblies shall be standard steel pedestal assemblies with continuously welded top and bottom flange fittings. Flanges shall have provisions for fasteners to the floor and securing to the bench. Pedestal diameter shall be not less than 32 mm. Pedestal color and finish shall be selected from the manufacturer's standard colors.

Fasteners.--

Fasteners for fastening seat units and support assemblies shall be the manufacturer's standard fasteners for the purpose intended.

PART 3.- EXECUTION

Installation.--Bottom flange fittings of the support assemblies shall bear solidly on the floor without rocking and shall be fastened rigidly and securely to the floor in accordance with the manufacturer's recommendations.

12-10.09 FIRE EXTINGUISHERS AND CABINETS

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing fire extinguishers with cabinets in accordance with the details shown on the plans and these special provisions.

REFERENCES.--

General.--Fire Extinguishers shall conform to the requirements in California Code of Regulations, Title 19 Division 1, Chapter 3, "Portable Fire Extinguishers."

SUBMITTALS.--

Product data.--Manufacturer's descriptive data and installation instructions shall be submitted for approval.

QUALITY ASSURANCE.--

Codes and standards.--Fire extinguishers shall be Underwriters Laboratories or Factory Mutual Laboratories approved for the type, rating and classification of extinguisher specified.

PART 2.- PRODUCTS

MANUFACTURER'S.--

Acceptable manufacturers,--Subject to contract compliance, manufacturers shall be J. L. Industries; Larsen's Manufacturing; Potter-Roemer; or equal.

COMPONENTS.--

Fire extinguisher.--

Fire extinguisher shall be fully charged, multi-purpose dry chemical type, with charge indicator, hose and nozzle, and attached service record tag. Fire extinguisher shall be of the capacity and type rating shown on the plans.

Fire extinguisher cabinet.--

Fire extinguisher cabinet shall be factory fabricated, constructed of steel with a clear plastic panel in a steel door frame, and shall have a baked enamel finish. Color to be selected from the manufacturer's standard colors.

Fire extinguisher cabinet shall be semi-recessed as shown on the plans.

PART 3.- EXECUTION

INSTALLATION.--

General.--Fire extinguishers shall be installed in locations and mounted at a height of 1220 mm from the finished floor to the top of the fire extinguisher.

Fire extinguisher cabinets shall be attached to structure, square and plumb, in accordance with the manufacturer's recommendations.

IDENTIFICATION.--

Cabinet-mounted.--Extinguishers in cabinets shall be identified with letter spelling "FIRE EXTINGUISHER" applied to the cabinet door. Letter size, styles, and color shall be selected from manufacturer's standard arrangements.

SERVICING.--

General.--Fire extinguishers shall be serviced, charged, and tagged not more than 5 days prior to contract acceptance.

12-10.10 FREE STANDING STEEL SHELVING

GENERAL.--This work shall consist of furnishing and installing free standing steel shelving in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--Manufacturer's descriptive data, installation instructions and standard color palette shall be submitted for approval. The color will be selected from the manufacturer's standard color pallette.

PRODUCTS.--

Shelving.--

Shelving shall be factory fabricated steel shelves and supports capable of supporting loads of 1200 Pa of shelf area. Shelves shall not deflect more than 8 mm when subjected to the loads specified herein and shall show no permanent deflection after removal of such loads. Shelves shall be supported and attached by means of clips. Studs or bolts shall not be used. Shelves shall be adjustable in vertical increments of 75 mm or less. Shelving shall be of the approximate dimensions and number shown on the plans and shall have a baked enamel finish.

EXECUTION.--Free standing steel shelving shall be installed in accordance with the manufacturer's instructions.

12-10.11 TOILET AND SHOWER ACCESSORIES

PART 1.- GENERAL

Scope.--This work shall consist of furnishing and installing toilet and shower accessories in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data and installation instructions and details shall be submitted for approval.

PART 2.- PRODUCTS

Toilet tissue dispenser.--

Toilet tissue dispenser shall be dual roll, surface mounted, stainless steel with satin finish, approximately 150 mm x 290 mm x 150 mm deep. Dispenser shall utilize standard toilet tissue rolls. The top roll shall automatically drop into place after the bottom roll is depleted. One dispenser per toilet stall.

Toilet seat cover dispenser.--

Toilet seat cover dispenser shall be white plastic dispenser, approximately 210 mm x 320 mm x 48 mm deep, single pack. One dispenser per toilet stall.

Napkin receptacle.--

Napkin receptacle shall be wall hung, white enameled sheet steel napkin receptacle with hinged top and bottom, disposable liner, approximate 3.8 liter capacity container. One receptacle per women's toilet stall.

Waste receptacle.--

Waste receptacle shall be white enameled sheet steel waste receptacle, 45 liter minimum capacity. One receptacle per toilet room.

Clothes hook.--

Clothes hook shall be stainless steel clothes hook with 2 prongs.

Paper towel dispenser.--

Paper towel dispenser shall be white enameled sheet steel towel dispenser with a capacity of 1000 single fold paper towels. One dispenser per lavatory.

Liquid soap dispenser.--

Liquid soap dispenser shall be surface mounted, heavy duty plastic dispenser for industrial use with a capacity of at least 710 mL. One dispenser per lavatory.

Mirror, wall hung.--

Mirror, wall hung shall be Number 1 quality, 6 mm thick, electrolytically copper plated float or plate glass mirror with nonmoisture-absorbing filler. Mirror shall have a heavy gage galvanized steel back and stainless steel frame. The frame shall have a satin finish and shall be mitered and welded and the corners shall be ground smooth. Fasteners shall not penetrate surfaces of the frame exposed to view. Mirror shall conform to Federal Specification: DD-M-411b and shall be guaranteed against silver spoilage for not less than 10 years.

Mirror, wall hung with shelf (women).--

Mirror, wall hung shall be Number 1 quality, 6 mm thick, electrolytically copper plated float or plate glass mirror with nonmoisture-absorbing filler. Mirror shall have a heavy gage galvanized steel back and stainless steel frame with integral 127 mm wide stainless steel shelf. The frame shall have a satin finish and shall be mitered and welded and the corners shall be ground smooth. Fasteners shall not penetrate surfaces of the frame exposed to view. Mirror shall conform to Federal Specification: DD-M-411b and shall be guaranteed against silver spoilage for not less than 10 years.

Steel grab bars.--

Steel grab bars shall be stainless steel, 38 mm diameter bars and escutcheon covered integral mounting flanges.

PART 3.- EXECUTION

Installation.--Toilet and shower accessories shall be installed in accordance with the manufacturer's recommendations. Fasteners for mounting accessories shall be concealed and tamper proof.

Expansion anchors shall be used for mounting accessories on masonry or concrete walls.

Toilet and shower accessories shall be mounted after painting work is complete.

All toilet room accessories shall be mounted plumb, secure and rigid. Grab bars shall be supported adequately so the bars will withstand an applied load of 113 kg at any point.

Support assembly for folding seat shall bear solidly on the wall without rocking and shall be fastened rigidly and securely to the wall in accordance with the manufacturer's recommendations.

SECTION 12-11. EQUIPMENT

12-11.01 HIGH PRESSURE WASHER (STATIONARY)

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing a stationary high pressure washer and accessories in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data for high pressure washer shall be submitted for approval.

Manufacturer's descriptive data shall include a complete description, performance data and installation instructions for the materials and accessories specified herein.

CLOSEOUT SUBMITTALS.--

Operation and maintenance manuals.--Prior to the completion of the contract, 3 identified copies of the operation and maintenance instructions with parts lists for the equipment specified herein shall be delivered to the Engineer at the jobsite. The instructions and parts lists shall be in a bound manual form and shall be complete and adequate for the equipment installed. Inadequate or incomplete material shall be returned. The Contractor shall resubmit adequate and complete manuals at no expense to the State.

WARRANTY.--

Warranties and guarantees.--Manufacturers warranties and guarantees for materials or equipment used in the work shall be delivered to the Engineer at the jobsite prior to acceptance of the contract.

PART 2.- PRODUCTS

MANUFACTURERS.--

Acceptable manufacturers.--Subject to compliance with the requirements, high pressure washer shall be Whitco, E1020213; Hydroblaster, EHGV 10/2000; or equal.

MANUFACTURED UNITS.--

High pressure washer.--

High pressure washer shall be stationary type, electric motor driven, LPG-fired, automatic operating type washer designed for continuous operation. The washer shall have a capacity of 38 liters per minute of hot water solution heated to 49°C at 13,800 kPa. The washer burner shall be natural draft, with automatic electric ignition and flame monitoring system. Heater unit shall be factor preset to operate between 15.5°C and 49°C. The heating coil shall have an inside diameter of not less than 12 mm. The unit shall be completely housed in a steel cabinet with parts shielded from spray or splash.

Washer unit shall be equipped with a remote on/off pump motor and washer heater switch control panel. All controls including remote operator shall be 24-volt AC. Unit shall have a timer automatic shutdown system preset for two minutes. The motor shall be 11 kW, 230 VAC, 3 phase as shown on the plans.

The control panel shall display temperature and pressure gauges and shall mount the motor starter and the power disconnect breaker.

The unit shall be equipped with safety controls, safety valve, vent stack and the following accessories: heavy duty gun with trigger control; 10 mm diameter by 15 meters in length, high pressure hose with 2 swivel ends rated for 20,700 kPa at 121°C; spray nozzles to allow flat, round and wide angle spray; and a wall mounted hose and gun reel.

ACCESSORIES.--

Pressure washer pipe and fittings.--

Pressure washer pipe and fittings shall be as recommended by the high pressure washer manufacturer.

Drum dolly.--

Drum dolly shall have welded steel construction with a cross braced bottom and a 50 mm continuous perimeter lip, 4 ball bearing casters with steel or semi-steel wheels. Drum dolly shall be sized to match the liquid detergent drum with a minimum capacity of 450 kg.

Vent stack.--

Vent stack shall be listed Class B. Vent stack shall include back draft diverter, fire stop spacer, ventilating thimble with drip cap and listed vent cap.

Hose and gun reel.--

Hose and gun reel shall be heavy duty assembly of steel construction with connecting hose, locking automatic ratchet, guide rollers and heavy duty spring activated hose pickup. Hose and gun reel shall have bushings, swivels, ball stops, and sized for a 15 m delivery hose. The reel shall have a baked enamel finish. Manufacturers reel mounting brackets shall be supplied with reel.

Soap/water mixing meter.--

The soap/water mixing meter shall be wall mounted, have a blend center consisting of; siphon breaker; kick-off spring; stainless steel enclosure; vinyl tubing; proportioner; ceramic weight; pipe plug; magnetic housing; push button; spring; spacer; plunger valve body; pipe to garden hose adapter; foot valve; inlet screen; and meter tip kit.

Non-emulsifying soap.--

Non-emulsifying soap shall be a commercially formulated, concentrated liquid that removes surface dirt, road film, and bug residue from vehicle exteriors with minimal brushing when used in conjunction with a high pressure washer. The soap shall contain no solvents, caustics, acids or phosphates. It shall work with hot or cold water, rinse easily and leave no unsightly soap film or streaks. A drum containing 208 liters of the product shall be supplied by, or approved by the manufacturer of the oil/water separator specified elsewhere in these special provisions. Product shall conform to the following:

Boiling point	>100°C
Specific Gravity	1.102
Solubility in water	100%
Evaporation rate	>1
pH	11-12

Expansion anchors.--

Expansion anchors shall be ICBO approved, integral stud type or internally threaded type with independent stud complete with hex nut and cut washer.

PART 3.- EXECUTION

INSTALLATION.--

General.--The high pressure washer shall be installed in accordance with the manufacturer's recommendations.

A reduced pressure backflow preventer shall be installed in the water line prior to the unit. Piping shall be installed to provide a minimum headroom clearance of 2.5 meters. Piping shall not be installed in travel areas at floor level.

Hose and gun brackets shall be installed on the wall to hold both the hot water hose and the gun with extension. Location shall be approved by the Engineer. Hose brackets shall be attached to the wall with lag screws or expansion anchors.

Hose and gun reel assembly shall be attached to the wall with 6 mm (minimum) stud type expansion anchors. If hose and gun reel does not include brackets for the gun nozzle, wall brackets shall be installed at the Contractor's expense.

Factory fittings for mixing meter shall be installed on the 208 liter drum of non-emulsified soap and placed on the drum dolly. Soap and dolly shall be ready for use and placed in the utility building or other location as designated by the Engineer.

FIELD QUALITY CONTROL.--

Testing.--Testing of the high pressure washer shall be conducted by the Contractor in the presence of the Engineer.

The Contractor shall notify the Engineer in writing not less than 5 days prior to the time that testing is to be conducted.

12-11.02 LUBRICATION AND COMPRESSED AIR SYSTEMS

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing compressed air systems in accordance with the details shown on the plans and these special provisions.

The compressed air system shall include a compressor, regulators, gauges and compressed air piping.
Pipes and fittings shall be in accordance with the requirements specified under "Pipes, Fittings, and Valves," in Section 12-15, "Mechanical," of these special provisions.

Permits to operate.--Attention is directed to the latest Division of Industrial Safety (DIS) regulations regarding tank mounted air compressors.

The Contractor shall provide all permits to operate pressure vessels in accordance with the requirements of the DIS and shall pay all costs for such permits. Such permits shall be posted under glass at the work site.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data shall be submitted for approval.

Manufacturer's descriptive data shall include a complete description, performance data and installation instructions for the materials and equipment specified herein.

CLOSEOUT SUBMITTALS.--

Operation and maintenance manuals.--Prior to the completion of the contract, 3 identified copies of the operation and maintenance instructions with parts lists for the equipment specified herein shall be delivered to the Engineer at the jobsite. The instructions and parts lists shall be in a bound manual form and shall be complete and adequate for the equipment installed. Inadequate or incomplete material shall be returned. The Contractor shall resubmit adequate and complete manuals at no expense to the State.

WARRANTY.--

Warranties and guarantees.--Manufacturer's warranties and guarantees for materials or equipment used in the work shall be delivered to the Engineer at the jobsite prior to acceptance of the contract.

PART 2.- PRODUCTS

MISCELLANEOUS COMPONENTS.--

Air compressor.--

Air compressor shall be 2-stage, 1210 kPa design, 860 kPa output, mounted on an ASME code vertical type receiver. The air compressor shall be complete with unloader, V-belt drive, belt guard, oil and air pressure gauges, automatic pressure controller, outlet valve, ASME relief valve, air intake filter, ball valve drain and an automatic tank drain operated by either the compressor unloader or a governor. Motor shall be high efficiency type, open dripproof with class B insulation. Air compressor shall be Champion, Ingersol Rand, Kellogg, or equal.

Pressure regulator.--

Pressure regulator shall be combination type with filter, bowl, pressure regulator and pressure gauge.

The filter bowl shall be the quick disconnect type, plastic with metal guard, manual drain, and 5 micron filter.

Pressure regulator shall be diaphragm controlled, balanced valve type, rated for 0 to 1100 kPa operation and shall be equipped with pressure gage, bottom clean-out plugs and internal strainers. Regulator shall be Wilkerson, Lincoln, Wabco, or equal.

Flexible coupling.--

Flexible coupling shall be brass flexible metal hose with threaded union ends and a minimum working pressure of 1380 kPa.

Pressure gage.--

Pressure gage shall be rotary type ANSI Standard: B40.1, Grade A, with 90 mm dial, liquid filled with cover, plain case, reset screw and bottom inlet. Pressure gage movement shall be phosphor bronze bushed. Gage shall read from 0 kPa to 1100 kPa. Each gage shall be equipped with a gage cock. Pressure gage shall be Marsh, Ashcroft, US Gage, or equal.

PART 3.- EXECUTION

INSTALLATION.--

Air compressor shall be installed with drain piping, vibration isolation pads and expansion anchors.
Unions shall be installed before and after the pressure regulator/ball valve assembly.

FIELD QUALITY CONTROL.--

Testing.--All tests, including general performance tests to demonstrate the proper operation of the air compressor, shall be performed by the Contractor in the presence of the Engineer.

The air compressor system shall be tested for the operational range, the cut-off pressure and the operation of air drops and system components.

12-11.03 EXHAUST EVACUATION HOSE REEL AND FAN

PART 1.- GENERAL

Scope.--This work shall consist of furnishing and installing exhaust evacuation hose reel and fan equipment, including overhead fume exhaust fan, hose reel, hose and remote operating station. All work shall be done in accordance with the details shown on the plans and these special provisions.

Supports, mechanical and electrical work and all other work incidental to, and necessary for, the proper installation and operation of the items of equipment shall conform to the requirements specified for similar work elsewhere in these special provisions.

SUBMITTALS.--

Product data.--Manufacturer's description data, installation recommendations, working drawings, schematic diagram, interconnection diagram, including reel installation mounting brackets, shall be submitted for approval. Fan, hose reel and push button station shall be from same manufacturer. System shall be Nederman, CarMon or equal.

PART 2.- PRODUCTS

Exhaust evacuation fan.--

Exhaust evacuation fan shall be centrifugal AMCA certified exhaust fan suitable for diesel or gasoline powered vehicle exhaust applications. Fan parts exposed to air stream shall be coated to prevent acid corrosion. The exhaust evacuation fan shall be mounted with vibration isolators on the reel. The fan size and performance shall be as shown on plans.

Hose reel assembly.--

Hose reel assembly shall be provided with 9 m minimum of 150 mm diameter flexible hose. The hose reel shall be motor operated and shall be capable of unwinding and recoiling the hose from a remote operating station. All electrical equipment necessary for operation shall be mounted on the hose reel assembly except for the remote operating station. The hose reel motor shall be interlocked with an adjustable limit switch that stops the reel when the tubing has been fully extended or fully retracted.

Hose.--

Exhaust hose shall be fabricated of a high strength woven glass fiber cloth supported by a helically wound spring steel wire. The hose shall be capable of withstanding temperatures of 150°C and shall be supplied with a rubber nozzle of the same size as hose provided.

Pushbutton station.--

Pushbutton operating station shall consist of a 3 button (up, down, on/off) controller wired directly to the hose reel assembly. The up and down buttons shall be momentary push button type.

Control panel.--

Control panel shall be a complete system routinely advertised, furnished and guaranteed by the exhaust evacuation hose reel and fan manufacturer.

Control panel shall include circuit breakers, starters, fan motor contactor, power supply, limit switch and controls that are required for proper operation.

PART 3.- EXECUTION

INSTALLATION.--

General.--The exhaust evacuation hose reel and fan shall be installed in accordance with the manufacturer's recommendations. The exhaust evacuation units and pushbutton station shall be located as shown on the plans.

FIELD QUALITY CONTROL.--

Testing.--The test shall consist of a general performance test to demonstrate the proper operation of the exhaust evacuation hose reel and fan system. The test shall be performed by the Contractor in the presence of the Engineer.

12-11.04 OIL/WATER SEPARATOR

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing a premanufacured double wall fiberglass oil/water separator and appurtenances in accordance with the details shown on the plans and these special provisions.

Pipes, fittings, devices, aprons, appurtenances, and other items or details, not mentioned, which are required for the construction and proper operation of the oil/water separator shall be furnished, placed, constructed, or installed as required.

Related work.--

Pipes, fittings, manholes, precast boxes and covers, valves, manhole frames and covers, cleanouts, coatings, and similar equipment shall conform to the applicable requirements specified under "Sanitary Sewage Disposal System" in Section 12-2, "Sitework," of these special provisions.

Earthwork for installation of pipes, oil/water separator and other appurtenances shall be as specified under "Earthwork for Building Work" in Section 12-2, "Sitework," of these special provisions.

Cast-in-place concrete and reinforcement for oil/water separator slab shall conform to the applicable requirements for concrete (structural work) specified under "Cast-in-Place Concrete" in Section 12-3, "Concrete and Reinforcement," of these special provisions.

SUBMITTALS.--

Product data.--Product list for material to be used shall be submitted for approval and shall include the name of the manufacturer and the source, model number, description, and standards of manufacturer.

Manufacturer's independent laboratory tests results demonstrating compliance to removal standards under stated test conditions as specified elsewhere under "oil water separator," descriptive data and catalog cuts for oil/water separator, oil level sensor, hydrostatic monitor sensor, control panel and appurtenances shall be submitted for approval.

Manufacturer's descriptive data and catalog cuts shall be submitted for the following:

Oil /water separator
Transfer pump
High and pump-out oil level sensors (including preset level)
Hydrostatic monitor reservoir sensor
Control panel

Working drawings.--Working drawings for the oil/water separator tank and appurtenances used in the work shall be submitted for approval. Bedding, assembly, installation and backfilling instructions for the oil/water separator tank shall be submitted for approval.

Operation and maintenance manuals.--Prior to the completion of the contract, 3 identical copies of the operation and maintenance instructions with parts lists for the equipment specified herein shall be delivered to the Engineer at the jobsite. The instruction and parts lists shall be indexed and bound in a manual form and shall be complete and adequate for the equipment installed. Inadequate or incomplete material shall be returned. The Contractor shall resubmit adequate and complete manuals at no expense to the State.

QUALITY ASSURANCE.--

Codes and standards.--Oil/water separator design criteria shall be in accordance with Stokes Law, the American Petroleum Institute (API) Manual on disposal of refinery wastes, and API Bulletin No. 1630 first edition and No. 421. The oil/water separator tank shall comply with Underwriters Laboratories, UL-1316 and bear their label. The oil/water separator

tank shall be manufactured in accordance with ASTM D-4021 specifications and shall meet National Fire Protection Association (NFPA 30) Flammable and Combustible Liquids Code and (NFPA 31) Standards for Installation of oil burning equipment.

Work shall conform to the applicable portions of the current approved Uniform Plumbing Code as amended by the applicable portions of current approved Title 24 California Building Standards Code, pertaining to the selection and installation of oil water separator materials and products.

Oil/water separator tank and loading calculations shall be submitted to the Engineer for approval. The design and calculations submitted for approval shall be signed by a civil engineer registered in the State of California.

Certificates of Compliance.--Certificates of Compliance shall be furnished for oil/water separator, oil level sensor, hydrostatic monitor reservoir sensor and control panel in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

Quality control.--All equipment in this section will be pre-tested at the factory prior to shipment.

PART 2.- PRODUCTS

MANUFACTURED UNITS.--

Oil/Water Separator.--

Oil/Water separator shall be 1.2-m diameter by 4.8-m long minimum factory manufactured equipment wash down cylindrical tank with double wall (primary and secondary walls) with annular space for monitoring fluid. The tank shall be inert to petroleum products with tank laminate of fiberglass cloth reinforcing. The tank shall be a fiberglass gravity displacement tank designed for intermittent variable flows, capable of storing 208-liters, minimum of grease and oils to at least 65˚C and designed for minimum total spill capacity of 2006-liters.

The oil/water separator shall be equipped with integrally mounted hydrostatic monitor with monitoring fluid in annular space; oil level sensor; enhanced oil separation by a minimum of 4 removable rust-proof polypropylene coalesce packs and associated mounting hardware and fittings; one 0.76-m minimum diameter manhole with fiberglass manhole extension; a 1.2-m diameter turbine enclosure field fiberglass bonded to the containment collar; inlet fittings; outlet fittings; oil pumpout fittings; vent fittings and all appurtenances for a complete system as shown on the plans.

The oil/water separator shall remove: free floating oils not chemically emulsified, dissolved and settleable solids from oil/water mixtures, free oil droplets 20 microns and greater, oil and grease down to an effluent concentration not to exceed 10 milligrams per liter. Oil/water separator shall be Fluid Containment Company Inc., Shields Harper and Company, or equal. Oil/water separator with steel or metal are not allowed.

Manufacturers shall warrant the tank not to fail from internal or exterior corrosion for a period of 30 years from date of purchase. The warranty shall not contain disclaimers for the influent constituents specified to be removed.

Oil/water separator shall include oil level sensor and sludge level sensor pre-installed at the factory in conformance with appropriate settings.

Tanks shall be designed to support all the loads and pressures resulting from the following vertical and lateral earth loading:

1. Minimum 1.5 meter cover over the tank.
2. Earth Density: 1922 kg/m^3.
3. Equivalent fluid pressure for lateral pressure due to earth: 480 kg/m^3.
4. All construction or appurtenance joint(s) shall be above the tank waterline.

Control panel.--

Control panel shall be premanufactured by oil/water separator manufacturer and shall be a solid state control panel utilizing intrinsically safe circuitry to be used with sensors in Class-1, Group C and D locations. Control panel shall have the following features:

1. Suitable for 120 volts input power.
2. NEMA-4X corrosion proof and weather tight enclosure.
3. Auxiliary contact for remote annunciation.
4. Four-input channels suitable for use with hydrostatic monitor reservoir sensor, and high and pump-out oil level sensors.
5. One dry type single-pole, double-throw contact per channel on the out-put side for interfacing with Remote Terminal Unit.
6. 95 dB minimum alarm bell with adjustable loudness.
7. Adjustable auto-silence (30 seconds to 3 minutes) for alarm bell only.
8. Pilot lights for pump out oil level, high oil level, and hydrostatic tank monitor.
9. Alarm bell silence push-button.
10. Circuit test push-button.
11. Dip switches for pump out and high oil settings.
12. 120-volt output for wiring external alarm light, AL.

Hydrostatic monitor reservoir sensor.--
The hydrostatic monitor reservoir sensor shall be furnished by oil/water separator manufacturer and shall be intrinsically safe sensor circuits suitable for use with the Oil/Water Separator Control Panel.

Oil level sensor.--

Oil level sensor shall be furnished by oil/water separator manufacturer and shall be intrinsically safe sensor circuits suitable for use with the Oil/Water Separator Control Panel; level sensor float shall sink in oil and float on water based on the specific gravity's as shown under "Oil/Water Separator," elsewhere in this specification.

ACCESSORIES.--

Coalescer pack removal hooks.--

Two galvanized steel coalescer pack removal hooks with handles and sufficient length and design to remove coalescer packs while standing at manhole surface elevation shall be provided.

Transfer pump.--

Transfer pump shall be a hand-operated, non-sparking, self-priming pump capable of handling granular and stringy solids without clogging. Pump shall be capable of 3.6 m suction lift and a 3.6 m delivery head. Pump housing shall be Delrin (injection molded) with a Buna-N diaphragm. Anodized aluminum handles shall have a non-slip grip. All ports (25 mm OD.) have a non-slip hose connection and shall be adapted for a 19 mm garden hose threads (male and female). Pump shall be capable of pumping 37 liters per minute.

PART 3.- EXECUTION

General.--Manufactured oil/water separator tank, and other appurtenances shall be installed in accordance with the plans, these specifications, codes and standards and/or manufacturer's recommendations, where applicable when approved by the Engineer, and the approved working drawings.

Fiberglass manhole riser extensions shall be installed and bolted watertight with stainless steel nuts, bolts, gaskets and washers in conformance to the manufacturer's recommendations and these specifications. The 760 mm minimum diameter manhole extension shall be constructed to grade as shown on the plans; the 1220 mm diameter turbine enclosure shall be field bonded watertight per manufacturer's recommendations and have a lift out removable lid as shown on the plans.

A reinforced concrete slab shall be cast in place over the oil/water tank. The slab shall be placed at grade and include cast iron frames in accordance with the details shown on the plans.

Oil/water separator shall be filled to operating level with clean, fresh water upon completion of construction.

Oil level sensor pumpout level shall be preset and installed by the manufacturer for the liters of the tank specified and submitted to the engineer for approval.

No individual structure shall be constructed to final grade until the paving or surfacing grades have been established in the immediate area.

Surveying shall conform to the requirement specified under "Field Engineering" in Section 12-1, "General Requirements," of these special provisions.

All construction joints shall be watertight.

The edge and bottom of manhole cover seat areas shall be coated with a uniform application of heavy duty, waterproof automotive or industrial grease.

Coalesar pack removal hooks and transfer pump shall be submitted to the Engineer at the jobsite in new working condition.

FIELD QUALITY CONTROL.--

Testing.--The oil/water separator shall be tested for leakage by filling the tank with water to the level of the outflow line for a period of 24 hours. All seams and joints shall be left exposed (except the bottom of the tank) for inspection purposes. The tank shall remain watertight. Repairs, if necessary, shall be made at the Contractor's expense.

12-11.05 SEWAGE PUMPING STATION EQUIPMENT

PART 1.- GENERAL

SUMMARY.--

Scope.--The work shall consist of furnishing and installing sewage pumping station equipment in accordance with the details shown on the plans and these special provisions.

Earthwork, foundations, electrical, and all other work incidental and necessary for the proper installation and operation of the work shall conform to the requirements for similar type work elsewhere in these special provisions.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data for all equipment, including installation instructions, shall be submitted for approval.

Manufacturer's descriptive data shall be submitted for the following:

Sewage grinder pump
Check valve
Discharge pipe and fittings
Access cover

Working drawings.--Working drawings shall be submitted for approval.

Working drawings shall show any changes in the proposed work, installation details of pumps and associated hardware, and dimensions and accurate locations of pumping equipment to avoid conflict with other work.

In the event the pumping equipment manufacturer requires a seal failure alarm system in order to warrant his equipment, the Contractor shall submit details of the circuit modification for approval and shall provide all necessary additional components and do all additional work connected thereto at no additional cost to the State.

Changes required by the Contractor's selection of pumping equipment from the details shown on the plans are to be made at no cost to the State and no further compensation will be allowed.

CLOSEOUT SUBMITTALS.--

Operation and maintenance manuals.--Before completion of project, 3 bound identified copies of operation maintenance instructions and parts lists for equipment furnished shall be delivered to the Engineer at the jobsite. Manuals that are inadequate or incomplete will be returned and the Contractor shall resubmit adequate and complete manuals.

QUALITY ASSURANCE.--

Certificates of Compliance.--Certificates of Compliance shall be furnished for sewage pumps in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

WARRANTY.--

Warranties and Guarantees.--Manufacturer's warranties and guarantees furnished for materials or equipment used in the work shall be delivered to the Engineer at the jobsite prior to acceptance of the contract.

PART 2.- PRODUCTS

MANUFACTURED UNITS.--

Sewage grinder pump.--

Sewage pump shall be a guide rail mounted, submersible type sewage grinder pump capable of handling raw, unscreened sewage and fibrous materials. The design shall be such that the pump unit shall be automatically and firmly connected and sealed to the discharge elbow when lowered into place by its mating connection. Sealing of the connection shall be accomplished by a machined metal-to-metal watertight contact. The pump shall be easily removable for inspection and service, without requiring bolts or other fasteners to be disconnected or removed. The pump, including appurtenances and cables, shall be capable of continuous submergence under water without loss of integrity.

Pump casing, bracket, and volute shall be gray cast iron construction.

The pump mating base shall be bolted to the sump floor with stainless steel expansion anchors. The mating base elbow shall be supplied with standard flanged connection for discharge pipe.

The pump motor shall be a submersible type, explosion proof, UL or FM approved for Class 1, Group D, Division 1 locations. Motor shaft shall be stainless steel. Motor shall be housed in a cast iron casing and shall have built-in thermal overload protection. Kilowatt rating and voltage shall be as shown on the plans.

The pump motor shall be protected from contamination, by the liquid being pumped, by a tandem, double-mechanical seal running in an oil reservoir. The outer seal shall be tungsten carbide. The oil reservoir of the pump shall be equipped with a seal failure alarm system as required by the manufacturer.

The pump motor shall be have portable Type-SO cord, or cords for pump power and overload, of sufficient length to reach from the pump to motor starter enclosure without splicing. Cords shall be sealed into the motor by the pump manufacturer.

EQUIPMENT.--

Check valve.--

Check valve shall be ball type with removable bolted top, ANSI B16.1 Class 125 flanges, with hollow steel ball with rubber cover.

Discharge pipe.--

Discharge pipe shall be Class 53 ductile iron, 860 kPa factory assembled threaded flanges, asphaltic coated and shall conform to ANSI/AWWA Designation: C115/A21.5. Flanges shall conform to ANSI B16.1, Class 125.

Discharge pipe fittings.--

Discharge pipe fittings shall be ductile iron, 860 kPa flanges with smooth insides and asphalt coating, and shall conform to ANSI/AWWA Designation: C110/A21.10.

Flexible couplings.--

Flexible couplings shall be gasketed short sleeve type couplings consisting of a mild steel middle ring with pipe stop, 2 rubber compounded wedge-section ring gaskets, 2 mild steel follower rings and sufficient mild steel bolts to compress the gaskets. All ferrous parts of the couplings shall be hot-dipped galvanized after fabrication. The couplings shall be assembled in such a manner as to insure a permanent watertight joint.

MISCELLANEOUS.--

Fasteners.--

Fasteners, including external nuts, bolts and washers shall be stainless steel unless otherwise shown on the plans.

Expansion anchors.--

Expansion anchors shall be stainless steel, ICBO approved, integral stud type anchor or internally threaded type with independent stud, hex nut and washer. Expansion anchors shall be 6 mm diameter, embedment shall be as recommended by the manufacturer.

Lifting cable.--

Lifting cable shall be stainless steel of adequate strength to raise and lower the pump. All related hardware shall be stainless steel.

Valve box.--

Valve box shall be precast standard commercial quality product with steel covers and extensions as required. Size shown on the plans shall be minimum internal clearances.

PART 3.- EXECUTION

INSTALLATION.--

General.--The sewage pumping station equipment shall be installed in accordance with the manufacturer's recommendations and the details shown on the plans.

FIELD QUALITY CONTROL.--

Tests.--Sewage pump shall be capable of pumping water, under test, at the given rates at the total heads indicated on the plans.

The pump, as installed, shall not load the motor to more than the nameplate amperage on the motor at the specified head. Service factor shall not be included in the rating.

12-11.06 ICE MACHINE

GENERAL.--This work shall consist of furnishing and installing an ice machine as shown on the plans and these special provisions.

SUBMITTALS.--Manufacturer's descriptive data and installation instructions shall be submitted for approval.

PRODUCTS.--

Ice machine.--

Ice machine shall be Manitowoc, Model QD-0282A; Scostman, Model SCE275A-1A; or equal.

EXECUTION.--

Installation shall be as recommended by the manufacturer.

12-11.07 GARBAGE DISPOSAL

GENERAL.--This work shall consist of furnishing and installing a garbage disposal as shown on the plans and these special provisions.

SUBMITTALS.--Manufacturer's descriptive data and installation instructions shall be submitted for approval.

PRODUCTS.--

Disposal.--

Disposal shall be a 1/2 HP, General Electric, GFC800R; Badger, V; or equal.

EXECUTION.--
Installation shall be as recommended by the manufacturer.

12-11.08 REFRIGERATOR

GENERAL.--This work shall consist of furnishing and installing an electric refrigerator unit as shown on the plans and these special provisions.

SUBMITTALS.--Manufacturer's descriptive data and installation instructions shall be submitted for approval.

PRODUCTS.--

Refrigerator.--

Refrigerator shall be free standing, 2 door, no frost type, UL listed, 120-volt AC, single phase, 60 hertz, with upper freezer compartment and automatic ice maker, and 2 vegetable/fruit pans, nominal 0.51 cubic meter capacity, with interior and door shelves. Refrigerator shall be of the following types: GE, TBX18CIB; Maytag, MTB1956BEA with UKI/000 ice maker; or equal

EXECUTION.--
Installation shall be as recommended by the manufacturer.
Color shall be as shown on the plans.

12-11.09 MICROWAVE OVEN

GENERAL.--This work shall consist of furnishing and installing a microwave oven as shown on the plans and these special provisions.
The color of crew room equipment shall be white.

SUBMITTALS.--Manufacturer's descriptive data and installation instructions shall be submitted for approval.

PRODUCTS.--

Microwave oven.--

Microwave oven shall be nominal 0.0283 m^3 feet capacity oven, UL listed, 120 volts AC, single phase, 60 hertz, electronic touch controls, multiple power levels, digital display with clock function. Microwave shall be of the following type: GE, JE1160WA; or equal.

EXECUTION.--
Installation shall be as recommended by the manufacturer.

12-11.10 WORKBENCH

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing a workbench in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data and standard color palette shall be submitted for approval.

PART 2.- PRODUCTS

Workbench.--

Workbench shall be standard, factory fabricated and factory painted heavy duty workbench unit with plywood reinforced steel top, drawers, curb and shelves. Plywood top reinforcement shall consist of two layers of securely fastened 19 mm thick exterior type plywood. The drawers, shelves and curb shall be as shown on the plans. Paint shall be an industrial grade enamel.

Leg anchors.--

Leg anchors shall be ICBO approved, integral stud type expansion anchors or internally threaded type anchors with independent stud.

PART 3.- EXECUTION

Installation.--The workbench shall be installed with the top level and the legs rigidly and securely fastened to the floor. Anchors for the legs shall be installed in accordance with the manufacturer's instructions.

SECTION 12-12. FURNISHINGS

12-12.01 HORIZONTAL BLINDS

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing horizontal blinds in accordance with the details shown on the plans and these special provisions.

Horizontal blinds shall be standard, factory manufactured assemblies suitable for use on exterior wall windows.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data, color chips, and installation instructions shall be submitted for approval.

PART 2.- PRODUCTS

Horizontal blinds.--

Horizontal blinds shall be nominal 25 mm wide, spring tempered virgin aluminum alloy horizontal slats supported by braided polyester ladders. Braided ladders shall hold slats at equal spaces, parallel, straight, and shall provide tilt control and adequate overlap of slats. The distance between ladders shall not exceed 585 mm. Slat tilt shall be adjustable by a transparent wand. Blinds shall be adjustable to any height using lift cords.

Hardware shall be enclosed in a metal head and the opening hardware shall be clinched to the head. All metal parts shall have a corrosion resistant coating.

PART 3.- EXECUTION

Installation.--Horizontal blinds shall be installed in accordance with the manufacturer's instructions.

SECTION 12-13. (BLANK)

SECTION 12-14. CONVEYING SYSTEMS

12-14.01 FREESTANDING BRIDGE CRANE AND HOIST

PART 1.- GENERAL

SUMMARY.--

Scope.--This work consists of designing, constructing, furnishing and installing a 2700-kilogram freestanding electric bridge crane with an electric powered hoist on a motorized trolley, in accordance with the details shown on the plans, the requirements specified in these special provisions, and the recommendations and instructions of the hoist manufacturer.

The work shall also include the design, construction, furnishing and installation of a self supported runway system consisting of bi-directional moment frames, crane runway rails, and the bridge girder for the trolley and hoist.

SYSTEM DESCRIPTION.--

Design requirements.--The self supported runway system consisting of bi-directional moment frames, crane runway rails, and the bridge girder shall be designed to support the crane and hoist loads, including the required safety factors, as recommended by the crane and hoist manufacturer for the crane capacity specified herein and as recommended by the Materials Handling Institute Standard No. 74, "Top Running and Underhung Single Girder Electric Overhead Traveling Cranes," and as required by Title 24 of the California Building Standards Code, Title 8 of the California Code of Regulations and the 1998 California Building Code.

The crane runway rails shall be located as shown on the plans. The approximate spacing of the structural steel support frames shall be as shown on the plans. The minimum vertical clearance shall be as shown on the plans.

The bridge girder shall be designed for the span between the crane runways. The approximate length of span between the crane runways shall be as shown on the plans. Final span length shall be determined by the manufacturer. The length of travel of the trolley at each end shall be determined by the Contractor and shall be the maximum that can be attained while maintaining adequate operating clearances between the crane assembly and the building in which it is installed.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data, performance data, parts list and installation instructions for the bridge crane and hoisting equipment shall be submitted for approval.

Working drawings.--Working drawings and design calculations for the self supported runway system consisting of bi-directional moment frames, crane runway rails and bridge girder shall be submitted for approval.

Working drawings shall include control panel schematic and wiring diagram, and a listing of electrical equipment and devices to be furnished.

Working drawings and design calculations shall be stamped and signed by an engineer who is registered as a Civil or Structural Engineer in the State of California.

CONTRACT CLOSEOUT SUBMITTALS.--

Operation and maintenance manuals.--Prior to the completion of the contract, 3 identified copies of the operation and maintenance instructions with parts lists for the equipment specified herein shall be delivered to the Engineer at the jobsite. The instructions and parts lists shall be indexed and bound in a manual form and shall be complete and adequate for the equipment installed. Inadequate or incomplete material shall be returned. The Contractor shall resubmit adequate and complete manuals at no expense to the State.

QUALITY ASSURANCE.--

Certificate of Compliance.--Certificates of Compliance shall be furnished for the bi-directional moment frames, crane runway rails, and bridge girder in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

Codes and standards.--All welding shall be in accordance with the requirements in American Welding Society (AWS) D14.1, "Specifications for Welding Industrial and Mill Crane and Other Material Handling Equipment."

PART 2.- PRODUCTS

MANUFACTURERS.--

Acceptable manufacturers.--Subject to project conditions, freestanding bridge crane and hoist shall be CraneVeyor Corp.; Lift-Tech International, Inc.; or equal.

MANUFACTURED UNITS.--

Bridge crane.--

General.--The electric bridge crane with a 2700-kilogram capacity shall include an electric powered hoist on a motorized trolley, power bar conductors, and pendant-type electrical controls.

The bridge crane shall be a 2700-kilogram capacity, motor driven, top running, single girder type crane. Bridge crane shall include bridge girder, end trucks, wheels, crane drive shaft, motor drive head, and drive motor. Bridge crane speed shall be 15 meters per minute.

The hoist and trolley shall be a 2700-kilogram, standard headroom, wire rope hoist mounted on a single-speed, electric motor driven trolley.

Crane control system shall consist of a bridge girder mounted control panel, festooned bridge conductor system, conductor bar system, travel limit switches, fully solid-state softstart for the bridge crane and trolley motors, and 7 button pendant station complete with strain relief hardware for full operation of hoist, trolley and bridge. Controls shall be actuated by the pendant station.

COMPONENTS.--

Bridge girder and trucks.--

Bridge girder shall be fabricated from structural steel conforming to ASTM Designation: A 36, and shall have a maximum deflection of 1/600 of the span length under maximum loading conditions. The bridge girder shall be provided with travel stops.

The end trucks shall be designed to run on the lower flange of the runway rails and shall be constructed of welded structural steel shapes conforming to ASTM Designation: A 36. The end trucks shall be motorized and shall have not less than 4 forged steel wheels with sealed, tapered roller bearings.

The drive motor shall be a single gear driven motor with a common drive shaft or a dual drive motor system. The drive motor shall be rated for Class C Service, crane travel duty, and shall be reversible with motor brake. Horsepower, voltage and phase shall be as shown on the plans.
The crane drive shaft for single motor operation shall be supported on lubricated pillow blocks with precision ball bearings.

Hoist and trolley.--

The trolley shall be motorized and shall have not less than 4 hardened forged steel wheels with sealed, tapered roller bearings. The trolley frame shall be of rigid construction. The trolley operating speed shall be nominal 12 meter per minute. The trolley motor shall be reversible, with motor brake. Power requirements, voltage and phase shall be as shown on the plans.

The hoist shall be oil bath gear driven flanged drum with machined grooves, mechanical type disc brake, heavy duty ball bearings, have a high limit switch for the hook travel, and shall be equipped with a load limiting clutch to prevent damage from overloads. Hook shall be forged steel, with 360 degree swivel and spring latch. The hoist

motor shall be continuous duty, reversible, with motor brake. Power requirements, voltage and phase shall be as shown on the plans.

Runway rails and moment frames.--

Runway rails and moment frames shall be fabricated from structural steel conforming to ASTM Designation: A 36. The rails shall have a maximum deflection of 1/600 of the span length under maximum loading conditions. The runway rails shall be provided with travel stops.

Control panel.--

Control panel shall be UL or FM listed for crane operation and shall include main disconnect, mainline contactor, hoist motor disconnect, bridge motor disconnect, trolley motor disconnect, hoist motor reversing starter, bridge motor reversing starter, trolley motor reversing starter, thermal overload relays, control transformer disconnect, control transformer, control relays, power terminal block and control terminal block. All contactors and starters shall be NEMA rated. Components shall be mounted on the interior mounting panel.

Control panel shall be a NEMA 12 enclosure, with interior mounting panel and hinged exterior dead front door. Control panel shall be factory prewired in conformance with Class-II Type 1C wiring. All wires entering or leaving the control panel shall terminate on terminal blocks. Control wires shall be 7 strand No. 14 Type MTW wires. Wiring shall be arranged such that any component may be removed without removing any wiring except that component's leads.

Control panel shall be a complete system, routinely advertised, furnished by the bridge crane and hoist manufacturer.

Power and control cable.--

Power and control cable shall be as recommended by the bridge crane and hoist manufacturer.

Festooned bridge conductor system.--

Festooned bridge conductor system shall consist of multi-conductor cable, cable grip, messenger chain, tag-line wire, 50 mm (inside diameter) conductor cable rings, take up brackets, 10 mm eye-bolts and other necessary hardware. Conductor sizes shall be as recommended by the hoist and trolley manufacturer.

Conductor bar system.--

Conductor bar system shall consist of enclosed power conductors, collectors and related covers, hangers, couplings and appurtenances. Conductor bar system shall be rated for 600 volts, 90 amperes continuous duty and 135 amperes intermittent duty. Conductor bars shall be one piece, copper conductors with thermoplastic insulating covers. End covers shall be provided. Collectors shall be spring loaded, replaceable shoe type rated for 150 meters per minute (minimum) travel.

FABRICATION.--

Shop finishing.—Freestanding bridge crane and hoist shall be cleaned and receive 2 coats of the manufacturer's standard paint.

Identification.--An information plate, with the following information, shall be attached to the bridge crane hoist and trolley.

Manufacturer's name and address
Model number
Serial number
Crane capacity
Hoist capacity
Date of installation

PART 3.- EXECUTION

INSTALLATION.--

General.--The bridge crane and hoist shall be installed in accordance with the manufacturer's instructions and the approved working drawings.

Crane runway sections shall be installed with couplings at joints to provide flush and level connections with a maximum gap between adjacent ends at the load-carrying flange not exceeding 2 mm except at free ends.

The bottom flanges of all crane runways shall be parallel and level with one another within a tolerance of plus or minus 6 mm throughout their entire length.

Hanger system shall provide for vertical adjustment of the runway beams so that the runways can be erected and maintained within level tolerance.

The crane control panel shall be mounted on the crane bridge and shall be actuated from a pendant station, suspended 1.2 meters above the floor. Main power and trolley power shall be by festooned bridge conductor system and shall be installed along the bridge crane from the control panel to the conductor bar system and trolley motor.

Each soft start unit for the bridge and trolley motors shall be enclosed in a NEMA 12 enclosure and may be installed near the bridge or trolley motor.

Power and control cables shall be fastened to the structural members with one-hole steel straps at a spacing of not to exceed 0.9 meter on center.

Field painting.--After installation, damaged and abraded areas of the shop paint shall be repainted using the same materials as applied in the shop.

FIELD QUALITY CONTROL.--

Tests.--The bridge crane and hoist shall be tested in the presence of the Engineer. Any equipment failure or malfunction shall be corrected by the Contractor at his expense.

Tests shall be as described herein:

NO LOAD TEST.--The trolley and hoist shall be operated to throughout the full length of the crane runways and the limits of hook travel. Travel limit switches shall be engaged.

LOAD TEST.--The minimum test load shall be 125 percent of the rated load capacity. The trolley shall be operated for the full length of the crane runways under the test load. The test load shall be raised to the hook height limit and lowered until the cable is slack. After a 5-minute waiting period, the test load shall be raised 300 mm foot and held in that position, without slipping, for a minimum time period of ten minutes.

LOSS OF POWER TEST.--The main power switch shall be opened while the test load is being lowered. The test load shall stop completely and immediately when the power switch is opened.

Manufacturer's field service.--The Contractor shall arrange for the bridge crane manufacturer's representative to be present during testing.

SECTION 12-15. MECHANICAL

12-15.01 MECHANICAL WORK

GENERAL.--

Scope.--This work shall consist of performing mechanical work in accordance with the details shown on the plans and these special provisions.

Mechanical work shall include furnishing all labor, materials, equipment and services required for providing heating, ventilating, air conditioning, plumbing and liquefied petroleum gas (LPG) distribution systems.

Earthwork, foundations, sheet metal, painting, electrical, and such other work incidental and necessary to the proper installation and operation of the mechanical work shall be in accordance with the requirements specified for similar type work elsewhere in these special provisions.

System layouts are generally diagrammatic and location of equipment is approximate. Exact routing of pipes, ducts, etc., and location of equipment is to be governed by structural conditions and obstructions. Equipment requiring maintenance and inspection is to be readily accessible.

Roof penetrations shall be flashed and sealed watertight in accordance with the requirements specified under "Sheet Metal Flashing" in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

SUBMITTALS.--

Product data.--A list of materials and equipment to be installed, manufacturer's descriptive data, and such other data as may be requested by the Engineer shall be submitted for approval.

Manufacturer's descriptive data shall include complete description, performance data and installation instructions for the materials and equipment specified herein. Control and wiring diagrams, rough-in dimensions for plumbing fixtures, and component layout shall be included where applicable.

Manufacturer's descriptive data shall be submitted for the following:

Furnace
Condensing unit
Cooling Coil
Fume exhaust fan
Declassification fan
Unit heater
Heat/vent/light fixture
Supply fan
Exhaust fan
Gas water heater
Electric water heater
Plumbing fixtures
Air compressor
Evaporative cooler
Boiler
Hydronic heating equipment
Backflow preventor
Water meter
LPG tank
LPG vaporizer

CLOSEOUT SUBMITTALS.--

Operation and maintenance manuals.--Prior to the completion of the contract, 3 identified copies of the operation and maintenance instructions with parts lists for the equipment specified herein shall be delivered to the Engineer at the jobsite. The instructions and parts lists shall be indexed and bound in a manual form and shall be complete and adequate for the equipment installed. Inadequate or incomplete material shall be returned. The Contractor shall resubmit adequate and complete manuals at no expense to the State.

Operation and maintenance manuals shall be submitted for the following equipment:

Furnace
Condensing unit
Cooling Coil
Fume exhaust fan
Declassification fan
Unit heater
Heat/vent/light fixture
Supply fan
Exhaust fan
Gas water heater
Electric water heater
Plumbing fixtures
Air compressor

Evaporative cooler
Boiler
Hydronic heating equipment
Backflow preventor
Water meter
LPG tank
LPG vaporizer

QUALITY ASSURANCE.--

Codes and standards.--Mechanical work, including equipment, materials and installation, shall conform to the California Building Standards Code, Title 24, and to the California Code of Regulations, Title 8, Chapter 4, Division of Industrial Safety (DIS).

WARRANTY.--

Warranties and guarantees.--Manufacturer's warranties and guarantees for materials or equipment used in the work shall be delivered to the Engineer at the jobsite prior to acceptance of the contract.

12-15.02 PIPE, FITTINGS AND VALVES

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing pipes, fittings and valves in accordance with the details shown on the plans and these special provisions. Pipe, fittings and valves shall include such plumbing and piping accessories and appurtenances, not mentioned, that are required for the proper installation and operation of the plumbing and piping systems.

Cathodic protection for underground piping shall be in accordance with the requirements specified under "Cathodic Protection," in Section 12-15, "Mechanical," of these special provisions.

The pipe sizes shown on the plans are nominal pipe size. No change in the pipe size shown on the plans shall be permitted without written permission from the Engineer.

The pipe and fitting classes and material descriptions shall be as specified herein. No change in class or description shall be permitted without written permission from the Engineer.

QUALITY ASSURANCE.--

Codes and standards.--Pipe, fittings and valves shall be installed in accordance with the requirements in the latest edition of the California Plumbing Code, the manufacturer's recommendations and the requirements specified herein.

PART 2.- PRODUCTS

MATERIALS.--

PIPE AND FITTINGS --

Class **Description**

A1.--

Schedule 40 galvanized steel pipe conforming to ASTM Designation: A 53, with 1040 kPa galvanized malleable iron banded screwed fittings and galvanized steel couplings. The weight of the zinc coating shall be not less than 90 percent of that specified in ASTM Designation: A 53.

A2.--

Schedule 40 galvanized steel pipe conforming to ASTM Designation: A 53, with black cast iron recessed drainage fittings. For rainwater leaders, neoprene-gasket compression couplings, Smith Blair, Dresser, or equal, may be used. The weight of the zinc coating shall be not less than 90 percent of that specified in ASTM Designation: A 53.

B2.--

Schedule 40 black steel pipe conforming to ASTM Designation: A 53, with 1040 kPa black malleable iron banded screwed fittings and black steel couplings.

Steel pipe coating, where required, shall be factory applied plastic. Pipe coating shall be Standard Pipe Protection, X-Tru-Coat (0.50 mm thick); Pipe Line Service Corporation, Republic; 3M Company, Scotchkote 205 (0.30 mm thick); or equal.

B3.--

Schedule 80 black steel pipe conforming to ASTM Designation: A 53 grade B, 50 mm and smaller shall be 20 700 kPa WOG socket welding fittings and couplings or 13 800 kPa WOG threaded forged steel, ASTM Designation: A 105. 65 mm and larger shall be extra strong weight butt welding fittings and couplings.

C1.--

Hub and plain end cast iron soil pipe with neoprene gaskets conforming to Cast Iron Soil Pipe Institute's Standard 301. Pipe, fittings and gaskets shall be of one manufacturer.

C2.--

Hubless cast iron soil pipe with neoprene gaskets, corrugated stainless steel shields and stainless steel clamps conforming to Cast Iron Soil Pipe Institute's Standard 301. Joint materials shall be furnished by pipe manufacturer.

H1.--

Type DWV hard copper tubing conforming to ASTM Designation: B 306, with DWV drainage fittings, stop type couplings and threaded adapters.

H2.--

Type K hard copper tubing conforming to ASTM Designation: B 88, with wrought copper or cast bronze solder joint pressure fittings, stop type couplings and threaded adapters. Solder shall be lead-free.

H3.--

Type L hard copper tubing conforming to ASTM Designation: B 88, with wrought copper or cast bronze solder joint pressure fittings, stop type couplings and threaded adapters. Solder shall be lead-free.

P2.--

Polyvinyl chloride (PVC) plastic pipe and fittings conforming to ASTM Designation: D 2241, Type I, Grade 1, Standard Dimension Ratio (SDR) 21, rated for 1380 kPa working pressure at 23°C, National Sanitation Foundation approved. Pipe shall have bell ends conforming to ASTM Designation: D 3139 with triple edge rubber sealing ring. For pipe sizes 50 mm diameter and smaller, plain end pipe with solvent welded fittings ASTM Designation: D 2241, Type I, Grade 1, Standard Dimension Ratio (SDR) 21, rated for 1380 kPa may be used.

P3.--

Polyvinyl chloride (PVC) standard weight pipe and fittings, Schedule 40, conforming to ASTM Designation: D 1785. Pipe shall meet or exceed requirements of National Sanitation Foundation Standard No. 14. Pipe shall have bell ends conforming to ASTM Designation: D 2672. For pipe sizes 75 mm and smaller, plain end pipe with solvent welded fittings conforming to ASTM Designation: D 2241, may be used.

P4.--

Polyvinyl chloride (PVC) plastic pipe and fittings shall conform to AWWA Designation: C900, class 150, Standard Dimension Ratio (SDR) 18. Pipe shall have bell end with a solid cross section elastomeric ring conforming to ASTM Designation: D 1869. Pipe shall be listed for fire protection.

P7.--

Cross-linked Polyethylene tube (PEX) with oxygen barrier conforming to ASTM Designation: F876/F877 and International Standard 9001. Tubing shall be flexible thermoplastic type rated for 690 kPa working pressure at 82°C. Tube shall have a 25-year warranty.

Unions (for steel pipe).--

Unions (for steel pipe) shall be 1730 kPa, threaded malleable iron, ground joint, brass to iron seat, galvanized or black to match piping.

Unions (for copper or brass pipe).--

Unions (for copper or brass pipe) shall be 1040 kPa cast bronze, ground joint, bronze to bronze seat with silver brazing threadless ends or 860 kPa cast brass, ground joint, brass to brass seat with threaded ends.

Unions (for brass waste and flush pipes).--

Unions (for brass waste and flush pipes) shall be slip or flange joint unions with soft rubber or leather gaskets. Unions shall be placed on the fixture side of the traps.

Dielectric waterway.--

Dielectric waterway shall be a premanufactured unit that incorporates an insulated interior lining at least 75 mm in length between the 2 pipes being connected while maintaining metal to metal contact on the exterior surface. Dielectric water way shall be listed by IAPMO (International Association of Plumbing and Mechanical Officials).

Insulating union.--

Insulating union or flange as applicable shall be suitable for the service on which used. Connections shall be constructed such that the 2 pipes being connected are completely insulated from each other with no metal to metal contact. Insulating couplings shall not be used. Insulating union shall be F. H. Maloney; Central Plastics; EPCO; or equal.

Insulating connection (to hot water tanks).--

Insulating connection (to hot water tanks) shall be 150 mm minimum, flexible copper tubing with dielectric union at each end and designed to withstand a pressure of 1040 kPa and a temperature of 93°C.

VALVES.--

Gate valve (65 mm and smaller).--

Gate valve (65 mm and smaller) shall be bronze body and trim, removable bonnet and non rising stem, Class 125 and same size as pipe in which installed. Gate valve shall be Crane, 438; Nibco Scott, T-113; Jenkins, 370; or equal.

Gate valve in nonferrous water piping systems may be solder joint type with bronze body and trim. Valve shall be Kitz, 59; Nibco Scott, S-113; Jenkins, 1240; or equal.

Gate valve (75 mm and larger, above ground).--

Gate valve (75 mm and larger, above ground) shall be iron body with bronze trim, removable bonnet and non-rising stem, class 125 and same size as pipe in which installed. Gate valve shall be Crane, 461; Nibco Scott, F-619; Jenkins, 326; or equal.

Gate valve (75 mm and larger, below ground).--

Gate valve (75 mm and larger, below ground) shall be AWWA double disc, hub or rubber ring type, removable bonnet and non-rising stem, equipped with operating nuts, 1380 kPa working pressure, and Tee handle wrench for each valve. Valve shall be Mueller, A-2380; American Valve, Model 28; or equal.

Ball valve.--

Ball valve shall be two piece, minimum 2760 kPa WOG, bronze body and chrome plated or brass ball with full size port. Valve shall be Nibco Scott, T-580; Watts, B-6000; Kitz, 56; or equal.

LPG gas valve.--

LPG gas valve shall be listed, 1730 kPa (minimum) WOG bronze ball valve. Valve shall be Jenkins, Model 30-A; Crane, Accesso; Watts; or equal.

Check valve (40 mm and smaller).--

Check valve (40 mm and smaller) shall be silent spring loaded type, threaded bronze body, nylon or teflon disc, beryllium or stainless steel helical spring and shaft, Class 125 and same size as pipe in which installed. Check valve shall be Nibco/Scott, T-480; CPV, 36; Kitz, 26; or equal.

Check valve (50 mm and larger).--

Check valve (50 mm and larger) shall be silent wafer type, full faced for installation between 860 kPa flanges, iron body with bronze trim, nylon or teflon disc, stainless steel helical spring and shaft, Class 125 and same size as pipe in which installed. Check valve shall be APCO, Series 300; CPV, 10D; Metraflex, Series 900; or equal.

Pressure reducing valve (PRV).--

Pressure reducing valve (PRV) shall be direct acting, spring loaded diaphragm type control valve with balanced single seat, bronze body, bronze trim and screwed connection. PRV shall be completely self-contained and shall require no external sending pipes or outside control medium. The outlet pressure of the PRV shall be adjustable within a range of 170 kPa to 400 kPa.

FAUCET AND HYDRANTS.--

Hose faucet.--

Hose faucet shall be compression type, angle pattern, wall flange at exterior locations, tee handle, 20 mm female thread with hose end, rough chrome or nickel plated finish for locations inside building, rough brass finish for others. Hose faucet shall be supplied with an integral or nonremovable threaded outlet vacuum breaker which meets the requirements of the American Society of Sanitary Engineering (ASSE) Standard: 1011. Hose faucet shall be Nibco, No. 63VB; Chicago, No. 13T; or equal.

Wall hydrant shall be 20 mm, non-freeze type, exposed, nickel bronze head with bronze casing, and integral vacuum breaker. Operating key shall be provided. Wall hydrant shall be J. R. Smith Model 5609 QT, Josam Model 71050, Zurn, Model 1310; or equal.

Wharf hydrant.--

Wharf hydrant shall be bronze, 2070 kPa working pressure, operating nut, lug type reducer and hose cap, and chain. Wharf hydrant shall have standard threads on inlet and National Standard Hose Threads on outlet. Lug type reducer shall have National Standard Hose Threads. Wharf hydrant shall be James Jones; Powhatan; John W. Moon Inc.; or equal.

A wharf hydrant operating nut wrench and hose spanner wrench or the combination type shall be provided for each wharf hydrant.

CLEANOUTS.--

Cleanout through wall.--

Cleanout through wall shall be cast iron cleanout tee type with polished stainless access plates. Plug shall be countersunk brass or bronze with tapered threads. Cleanout shall be Wade, No. W-8460; Smith, No. 4532; Zurn, No. 1445; or equal.

Cleanout through floor.--

Cleanout through floor shall have nonslip scoriated nickel bronze access plate and adjustable frame with square pattern top for ceramic tile and round pattern top for other finishes. Where floors are constructed with a membrane, access frame shall be provided with membrane clamping flange. Plug shall be countersunk brass or bronze with tapered threads. Cleanout shall be Wade, W-7000 Series; Smith, 4023 Series; Zurn, No. 1400; or equal.

Cleanout through floors in exterior locations shall be heavy duty, floating pipe type with cast iron cover. Cleanouts shall be Wade, No. W-8300-HF; Smith, No. 4253; Zurn, No. 1474; or equal.

MISCELLANEOUS ITEMS.--

Water hammer arrestor.--

Water hammer arrestor shall be stainless steel body with bellows or piston. Arrestor compression chambers shall be pneumatically charged. Water hammer arrestors shall be tested and certified in accordance with the Plumbing and Drainage Institute Standard: PDI-WH201 and sized as shown on the plans.

Access door.--

Access door shall be 1.52 mm prime coated steel, face mounting square frame, minimum 300 mm x 300 mm door with concealed hinge and screwdriver latch.

Compression stop (exposed).--

Compression stop (exposed) shall be metal full free waterway, angle type, ground joint union, non-rising stem, molded rubber seat and wheel handle.

Pressure gages (for PRV).--

Pressure gages (for PRV) shall have 0 to 700 kPa scale with 80 mm minimum diameter dial. Gages shall be installed within 150 mm of the inlet and outlet sides of the pressure reducing valve. Pressure gages shall be provided with a brass gage cock.

Gas regulator.--

Gas regulator shall be listed as suitable for LPG and equipped with full capacity relief valve, low pressure safety shut-off and weatherproof and insect proof vent for outside installation. Capacity shall be as shown on the plans. Gas regulator shall be Fisher; Reliance; Rockwell; or equal.

Wye strainer.--

Wye strainer shall be wye pattern, cast iron body and Type 304 stainless steel or monel strainer screen. The strainer screen shall have an open area equal to at least 3 times the cross sectional area of the pipe in which it is installed and shall be woven wire fabric with 20 mesh or perforated sheet with 850 micron maximum diameter holes.

Backflow preventer.--

Backflow preventer shall be factory assembled with 2 check valves, one pressure differential relief valve, 2 isolation valves and required test cocks. Backflow preventer shall be reduced pressure type.

Water meter.--

Water meter shall be turbine type, suitable for water service with a magnetic coupling and a minimum 860 kPa working pressure. Meter shall be sized according to the plans with a maximum pressure drop of 55 kPa (100 mm water meter) and 25 kPa (50 mm water meter). Readout shall be in gallons. Water meter shall be Badger; Neptune; Rockwell; Hersey; or equal.

Pipe hanger (for piping supported from overhead).--

Pipe hanger (for piping supported from overhead) shall be Grinnell, Model 269; Super Struct, C711; or equal.

Pipe wrapping tape and primer.--

Pipe wrapping tape shall be pressure sensitive polyvinyl chloride or pressure sensitive polyethylene tape having nominal thickness of 0.50 mm. Wrapping tape shall be Polyken, 922; Manville, Trantex VID-20; Scotchrap, 51; or equal.

Pipe wrapping primer shall be compatible with the pipe wrapping tape used.

Floor, wall, and ceiling plates.--

Floor, wall, and ceiling plates shall be chromium plated steel or plastic plates having screw or spring clamping devices and concealed hinges. Plates shall be sized to completely cover the hole.

Valve box.--

Valve box shall be precast high density concrete with polyethylene face and cast iron traffic rated cover marked "WATER," "GAS" or "CO-SS" as applicable. Extension shall be provided as required. Valve box shall be Christy, B3; Brooks Products Company, 3TL; Frazer, 3; or equal.

Floor drain.--

Floor drain shall be cast iron body and flashing collar, adjustable nickel bronze 150 mm strainer head with seepage openings and caulk or no-hub outlet. Floor drain shall be round or square as shown on the Architectural plans. Floor drain shall be J. R. Smith, 2005/2010; Wade, W-1100; Zurn, Z-415; or equal.

PART 3.- EXECUTION

INSTALLATION.--

INSTALLATION OF PIPES AND FITTINGS.--

Pipe and fittings.--Pipe and fittings shall be installed in accordance with the following designated uses:

Designated Use	Pipe and Fitting Class
Domestic water (CW and HW) in buildings	H3 or A1
Domestic water underground within 1.5 m of the building	A1 or H2
Domestic water underground 1.5 m beyond the building	P2, P3, P4, A1 or H2
Hydronic piping (except in slab)	H2
Hydronic floor tubing in slab	P7
Sanitary drain piping above ground in building	H1, C1, or C2
Sanitary drain and vent piping underground within 1.5 m of the building	C1 or C2
Sanitary vent piping above ground in building	A2, H1, C1, or C2
Liquefied petroleum gas (LPG), 860 kPa or less, above ground	A1 or B2
LPG, 860 kPa or less, underground	B2 (plastic coated)
LPG, exceeding 860 kPa	B3
Compressed air	A1
Equipment drains and relief valve discharge	H3 or A1

Installing piping.--Water piping shall be installed generally level, free of traps and bends, and arranged to conform to the building requirements.

Piping installed underground shall be tested as specified elsewhere in these special provisions before backfilling.

Public use areas, offices, rest rooms, locker rooms, crew rooms, training rooms, storage rooms in office areas, hallway type rooms, and similar type use areas shall have concealed piping.

Warehouse rooms, equipment bays, and loft areas shall have exposed piping.

Piping shall not be run in floor fill, except as shown on the plans.

Piping shall be installed parallel to walls. All obstructions shall be cleared, headroom preserved and openings and passageways kept clear whether shown or not. Piping shall not interfere with other work.

Where pipes pass through exterior walls, a clear space around pipe shall be provided. Space shall be caulked water tight with silicone caulk.

Underground copper pipe shall have brazed joints. Underground plastic pipe shall be buried with No. 14 solid bare copper wire. Wire ends at pipe ends shall be brought up 200 mm and looped around pipe.

Exposed supply and drain piping in rest rooms shall be chrome finished.

Piping and tubing for hydronic heating shall be installed in accordance with the requirements specified under "Hydronic Heating System," elsewhere in this Section 12-15.

Compressed air piping shall be pitched to low point. Ball valved drips shall be provided at all low points. Branches shall be taken off top of main.

Gas piping shall not be installed under building concrete slabs or structure. An insulating connection and valve shall be installed above ground at each building supply.

Gas piping shall be pitched to equipment or to low point and provided with a 200 mm minimum dirt leg.

Plastic pipe used for natural gas shall be below grade outside of building only. Transition to Class B2 plastic coated shall be before meter, regulator, or building wall with approved metal to plastic transition fitting. PVC natural gas pipe shall be installed in accordance with International Association of Plumbing and Mechanical Officials (IAPMO) Standard: IS10.

Forty-five degree bends shall be used where offsets are required in venting. Vent pipe headers shall be sloped to eliminate any water or condensation.

Vent piping shall extend a minimum of 200 mm above the roof.

Horizontal sanitary sewer pipe inside buildings shall be installed on a uniform grade of not less than 2 percent unless shown otherwise on the plans.

Drainage pipe shall be run as straight as possible and shall have easy bends with long turns.

Wye fittings and 1/8 or 1/16 bends shall be used where possible. Long sweep bends and combination Wye and 1/8 bends may be used only for the connection of branch pipes to fixtures and on vertical runs of pipe.

Water pipe near sewers.--Water pipe shall not be installed below sewer pipe in the same trench or at any crossing, or below sewer pipe in parallel trenches less than 3 m apart.

When a water pipe crosses above a sewer pipe, a vertical separation of at least 300 mm between the top of the sewer and the bottom of the water pipe shall be maintained.

When water and sewer pipe is installed in the same trench, the water pipe shall be on a solid shelf at least 300 mm above the top of the sewer pipe and 300 mm to one side.

Pipe sleeves.--The Contractor shall provide sleeves, inserts and openings necessary for the installation of pipe, fittings and valves. Damage to surrounding surfaces shall be patched to match existing.

PVC pipe sleeves shall be provided where each pipe passes through concrete floors, footings, walls or ceilings. Inside diameter of sleeves shall be at least 20 mm larger than outside diameter of pipe. Sleeves shall be installed to provide at least 10 mm space all around pipe the full depth of concrete. Space between pipes and pipe sleeves shall be caulked watertight.

Pipe penetrations in fire rated assemblies.--Where pipes pass through fire rated wall, floor or ceiling assemblies, the penetration shall be protected in accordance with the requirements specified under "Through-Penetration Firestopping," in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

Cutting pipe.--All pipe shall be cut straight and true and the ends shall be reamed to the full inside diameter of the pipe after cutting.

Damaged pipe.--Pipe that is cracked, bent or otherwise damaged shall be removed from the work.

Pipe joints and connections.--Joints in threaded steel pipe shall be made with teflon tape or a pipe joint compound that is nonhardening and noncorrosive, placed on the pipe and not in the fittings.

The use of thread cement or caulking on threaded joints will not be permitted. Threaded joints shall be made tight. Long screw or other packed joints will not be permitted. Any leaky joints shall be remade with new material.

Exposed polished or enameled connections to fixtures or equipment shall be made with special care, showing no tool marks or threads.

Cleaning and closing pipe.--The interior of all pipe shall be cleaned before installation. All openings shall be capped or plugged as soon as the pipe is installed to prevent the entrance of any materials. The caps or plugs shall remain in place until their removal is necessary for completion of the installation.

Securing pipe.--Pipe in the buildings shall be held in place by iron hangers, supports, pipe rests, anchors, sway braces, guides or other special hangers. Material for hangers and supports shall be compatible with the piping or neoprene isolators shall be used. Allowances shall be made for expansion and contraction. Steel pipe shall have hangers or supports every 3 m. Copper pipe 25 mm or smaller shall have hangers or supports every 2 m and sizes larger than 25 mm shall have hangers or supports every 3 m. Plastic pipe shall have hangers or supports every 1 m. Cast iron soil pipe with neoprene gaskets shall be supported at each joint. Vertical pipes shall be supported with clamps or straps. Horizontal and vertical piping shall be securely supported and braced to prevent swaying, sagging or flexing of joints.

Hangers and supports.--Hangers and supports shall be selected to withstand all conditions of loading to which the piping and associated equipment may be subjected and within the manufacturer's load ratings. Hangers and supports shall be spaced and distributed so as to avoid load concentrations and to minimize the loading effect on the building structure.

Hangers and supports shall be sized to fit the outside diameter of pipe or pipe insulation. Hangers shall be removable from around pipe and shall have provisions for vertical adjustment after erection. Turnbuckles may be used.

Materials for holding pipe in place shall be compatible with piping material.

Hanger rods shall be provided with locknuts at all threaded connections. Hanger rods shall be sized as follows:

Pipe Size	Minimum Hanger Rod Diameter
15 mm to 50 mm	10 mm
65 mm to 87 mm	13 mm
100 mm to 125 mm	16 mm
150 mm	19 mm

Wrapping and coating steel pipe.--Steel pipe buried in the ground shall be wrapped or shall be plastic coated as specified herein:

1. Wrapped steel pipe shall be thoroughly cleaned and primed as recommended by the tape manufacturer.

2. Tapes shall be tightly applied with 1/2 uniform lap, free from wrinkles and voids with approved wrapping machines and experienced operators to provide not less than 1.00 mm thickness.

3. Plastic coating on steel pipe shall be factory applied. Coating imperfections and damage shall be repaired to the satisfaction of the Engineer.

4. Field joints, fittings and valves for wrapped and plastic coated steel pipe shall be covered to provide continuous protection by puttying and double wrapping with 0.50 mm thick tape. Wrapping at joints shall extend a minimum of 150 mm over the adjacent pipe covering. Width of tape for wrapping fittings shall not exceed 50 mm. Adequate tension shall be applied so tape will conform closely to contours of fittings. Putty tape insulation compounds approved by the Engineer shall be used to fill voids and provide a smooth even surface for the application of the tape wrap.

Wrapped or coated pipe, fittings, and filed joints shall be approved by the Engineer after assembly. Piping shall be placed on temporary blocks to allow for inspection. Deficiencies shall be repaired to the satisfaction of the Engineer before backfilling or closing in.

Thrust blocks.--Thrust blocks shall be formed by pouring concrete between pipe and trench wall. Thrust blocks shall be sized and so placed as to take all thrusts created by maximum internal water pressure.

Plastic pipe underground shall be provided with thrust blocks and clamps at changes in direction of piping, connections or branches from mains 50 mm and larger, and all capped connections.

Union.--Unions shall be installed where shown and at each threaded or soldered connection to equipment and tanks. Unions shall be located so piping can be easily disconnected for removal of equipment or tanks. Unions shall be omitted at compression stops.

Dielectric waterway.--Dielectric waterway shall be provided between metal pipes of different material, and between brass or bronze valves and steel piping.

Insulating union and insulating connection.--Insulating union and insulating connection shall be provided where shown and at the following locations:

1. In metallic water, gas and air service connections into each. Insulating connections shall be installed on the exterior of the building, above ground and after shut-off valve.

2. In water, gas and air service connections in ground at point where new metallic pipes connect to existing metallic pipes. Install valve box above insulating connection.

3. At points of connections of copper or steel water pipes to steel domestic water heaters and tanks.

4. At each end of buried ferrous pipe protected by cathodic protection.

Bonding at insulating connections.--Interior water piping and other interior piping that may be electrically energized and are connected with insulating connections shall be bonded in accordance with the National Electrical Code. Bonding shall all be coordinated with electrical work.

Compression stop.--Each fixture, including hose faucets, shall be equipped with a compression stop installed on water supply pipes to permit repairs without shutting off water mains. Ball valves may be installed where shown on the plans or otherwise permitted by the Engineer.

INSTALLATION OF VALVES.--

Pressure reducing valve.--A capped tee connection and strainer shall be installed ahead of the pressure reducing valve.

Exterior valves.--Exterior valves located underground shall be installed in a valve box marked "Water." Extensions shall be provided as required.

INSTALLATION OF FAUCETS AND HYDRANTS.--

Hose faucets and hydrants.--Faucets and hydrants shall be installed with outlets 0.5 m above finished grade, unless otherwise shown on the plans.

INSTALLATION OF CLEANOUTS.--

Cleanouts.--A concrete pad 0.5 m long and 100 mm thick shall be placed across the full width of trench under cleanout Wye or 1/8 bend. Cast iron soil pipe (C1 or C2) and fittings shall be used from Wye to surface. Required clearance around cleanouts shall be maintained.

Cleanout risers outside of a building installed in a surface other than concrete shall terminate in a cleanout to grade. Cleanout to grade shall terminate in a valve box with cover marked "CO-SS". Top of box shall be set flush with finished grade. Cleanout plug shall be 100 mm below grade and shall be located in the box to provide sufficient room for rodding.

Cleanout risers installed in tile and concrete floors, including building aprons and sidewalks, shall terminate in a cleanout through floor.

INSTALLATION OF MISCELLANEOUS ITEMS.--

Water hammer arrestor.--Water hammer arrestor shall be installed so that they are vertical and accessible for replacement. Water hammer arrestor shall be installed with access door when in walls or there is no access to ceiling crawl spaces. Access door location shall be where shown on the plans or as approved by the Engineer.

Gas appliance connection.--Gas valve and flexible connector shall be provided for gas piping at each appliance. Appropriately rated gas cocks may be used in 15 mm gas pipe. Cock or valve shall be within one meter of the appliance.

Gas regulator.--Gas regulator shall be installed complete with dirt leg, capped test tee, union, insulating union, gas valve and fittings.

Backflow preventer.--Backflow preventer assembly shall include a wye strainer, backflow preventer, fittings and pipe. Assembly components shall be the same size as the pipe in which they are installed unless otherwise shown on the plans.

Backflow preventer shall be installed a minimum of 300 mm above ground and shall be the same size as the pipe in which it is installed unless otherwise shown on the plans.

Water meter.--Water meter shall be installed in horizontal piping run with no fittings located within 610 mm of either side of the 50 mm water meter and within 1000 mm of either side of the 100 mm water meter.

Flushing completed systems.--All completed systems shall be flushed and blown out.

Chlorination.--The Contractor shall flush and chlorinate all domestic water piping and fixtures.

Calcium hypochlorite granules or tablets, if used, shall not be applied in the dry form, but shall first be dissolved into a solution before application.

The Contractor shall take adequate precautions in handling chlorine so as not to endanger workmen or damage materials. All pipes and fittings shall be completely filled with water containing a minimum of 50 ppm available chlorine. Each outlet in the system shall be opened and water run to waste until a strong chlorine test is obtained. The line shall then be closed and the chlorine solution allowed to remain in the system for a minimum of 24 hours so that the line shall contain no less than 25 ppm chlorine throughout. After the retention period, the system shall be drained, flushed and refilled with fresh water.

FIELD QUALITY CONTROL.--

Testing.--The Contractor shall test piping at completion of roughing in, before backfilling, and at other times as directed by the Engineer.

The system shall be tested as a single unit, or in sections as approved by the Engineer. The Contractor shall furnish necessary materials, test pumps, instruments and labor and notify the Engineer at least 3 working days in advance of testing. After testing, the Contractor shall repair all leaks and retest to determine that leaks have been stopped. Surplus water shall be disposed of after testing as directed by the Engineer.

The Contractor shall take precautions to prevent joints from drawing while pipes and appurtenances are being tested. The Contractor shall repair damage to pipes and appurtenances or to other structures resulting from or caused by tests.

Cathodic protection tests.--The State will conduct tests at locations where cathodic protection is required to determine compliance with the specified requirements.

General tests.--All piping shall be tested after assembly and prior to backfill, pipe wrapping, connecting fixtures, wrapping joints and covering the pipe. Systems shall show no loss in pressure or visible leaks.

The Contractor shall test systems according to the following schedule for a period of not less than 4 hours:

Test Schedule		
Piping System	Test Pressure	Test Media
Sanitary sewer and vent	250 mm head	Water
Water	860 kPa	Water
Gas (except P6)	690 kPa	Air
Air	860 kPa	Air

During testing of water systems, valves shall be closed and pipeline filled with water. Provisions shall be made for release of air.

Sanitary sewers shall be cleared of obstructions before testing for leakage. The pipe shall be proved clear of obstructions by pulling an appropriate size inflatable plug through the pipe. The plug shall be moved slowly through the pipe with a tag line. The Contractor shall remove or repair any obstructions or irregularities.

Sanitary sewer pipes beyond 1.5 m perpendicular to the building shall be tested for leakage for a period of not less than 4 hours by filling with water to an elevation of 1.2 m above average invert of sewer or to top of manholes where less than 1.2 m deep. The system shall show no visible leaks The sewer may be tested in sections with testing water progressively passed down the sewer as feasible. Water shall be released at a rate that will not create water hammer or surge in plugged sections of sewer.

Testing backflow preventers.--Backflow preventers installed by the Contractor shall be tested at the completion of the supply system installation for proper operation by a certified Backflow Preventer Tester.

The tester shall hold a valid certificate as a Backflow Preventer Tester from the county in which the device to be tested is located or, if the county does not have a certification program for Backflow Preventer Testers, the tester shall have a certificate from one of the following:

1. The American Water Works Association.

2. A county which has a certification program for Backflow Preventer Testers. The certification under which the tester has been certified shall be acceptable to the water purveyor and the local agency having jurisdiction.

Testing for proper operation shall conform to the procedures of the county in which the testing is being performed, or, if such procedures are not available in the county, such tests shall conform to the provisions in the latest edition of the Guidance Manual For Cross Connection Control Program, which is available from the California Department of Health Services, Division of Drinking Water and Environmental Management, 601 N 7th Street, P.O. Box 942732, Sacramento, CA 94234.

The Contractor shall notify the Engineer at least 5 days prior to testing backflow preventers. Such tests shall be satisfactorily completed after installation of the backflow preventer assemblies and before operation of the systems.

One copy of all test results for each backflow preventer shall be furnished to the Engineer.

Full compensation for providing the certified Backflow Preventer Tester and for testing the backflow preventers shall be considered as included in the lump sum price paid for building work and no additional compensation will be allowed therefor.

12-15.03 MECHANICAL INSULATION

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing mechanical insulation in accordance with the details shown on the plans and these special provisions.

Piping insulation shall be installed on all domestic hot water piping, above grade, in non-conditioned spaces.

Piping insulation shall be installed on all hydronic supply and return piping, above and below grade unless shown otherwise on the plans.

P-trap, hot water supply pipes and angle valves for lavatories and sinks, except in janitor closets or similar enclosed spaces, shall be insulated.

Duct insulation shall be installed on all rigid ductwork installed in concealed non-conditioned spaces.

Duct liner shall be installed in all rectangular ductwork installed in exposed non-conditioned spaces and in exterior locations. Plenum liner shall be installed in all plenums in non-conditioned spaces or in walls facing a non-conditioned space.

QUALITY ASSURANCE.--

Codes and standards.--Mechanical insulation shall conform to California State Energy Commission regulations and, where applicable, shall meet American Society of Testing and Materials (ASTM) standards.

All materials shall bear the label of the Underwriters Laboratory (UL) or other approved testing laboratory indicating that the materials proposed for use conform to the required fire hazard ratings.

Pipe safety insulation shall conform to Section 1504(b) of Title 24, Part 5, California Plumbing Code.

PART 2.- PRODUCTS

MATERIAL.--

General.--All pipe insulation and wrapping material, including adhesives and jackets, located within buildings shall be certified to have a composite flame spread rating of not more than 25 and smoke development rating of not more than 450 when tested in accordance with ASTM Designation: E 84.

Duct insulation and wrapping material, including adhesives and jackets, located within buildings shall be certified to have a composite flame spread of not more than 25 and smoke development rating of not more than 50 when tested in accordance with ASTM Designation: E 84.

Domestic water and interior hydronic piping insulation.--

Piping insulation shall be glass fiber molded pipe insulation with factory applied jacket suitable for service temperatures up to 175°C. Covering jacket shall have pressure sealing lap adhesive joints. Pipe insulation shall have a minimum thermal resistance of R-0.5 K•m^2/W. Insulation and jackets shall be Owens-Corning, Fiberglass 25 with ASJ/SSL All Service Jacket; Manville, Micro-Lok 650ML with AP-T All Purpose Jacket; or equal.

Piping insulation cement.--

Insulation cement shall be Fenco, All Purpose Cement; Manville, JM375; or equal.

Exterior and in ground hydronic piping insulation

Piping insulation shall be polyurethane foam insulation with a service temperature range of 0°C to 120°C. A 0.15 mm vapor barrier shall be applied over the top off the insulation. The vapor barrier shall be installed with an adhesive as recommended by the manufacturer.

PVC jacket.--

PCV jacket shall be rated for a service temperature of 80°C. PVC jacket shall include covers specifically designed to cover pipe fittings.

Alternative pipe insulation.--

Alternative pipe insulation shall be closed cell, elastomeric material in a flexible tubular form. Insulation shall have a service temperature range between -40°C and 93°C, a minimum vapor transmission rating of 0.29 Perm-m, and a minimum thermal resistance of R-0.5 K•m^2/W.

Pipe safety insulation.--

Pipe safety insulation for P-traps, hot water supply pipes and angle valves shall be molded closed cell vinyl or closed cell foam with exterior vinyl surface. Pipe safety insulation shall be configured to protect against contact. Pipe safety insulation shall be Truebro Inc., Handi Lav-guard; Plumberex Specialty Products, Handy Shield; or equal.

External duct insulation.--

External duct insulation shall be 38 mm thick, 0.5 kg density glass-fiber blanket type. Material and coatings shall be fire resistive and shall be approved by the State Fire Marshal. External duct insulation shall be Fiberglas, Type PF-336; Ultralite, No. 100; Pittsburgh Plate Glass, Superfine; Johns-Manville, Microlite; Silvercote, Silvercel; or equal.

Plenum and duct liner.--

Plenum and duct liner shall be 25 mm minimum thickness. Material and coatings shall be fire resistive and shall be approved by the State Fire Marshal. Liner shall be Gustin-Bacon, Ultra-Liner duct insulation; Owens-Corning Fiberglas, Type CE; Gustin-Bacon, coated insulation Board No. 90-A; Owens-Corning Fiberglas 0.7 kg density coated flexible duct liner; Johns-Manville, MicroBar, or 0.7 kg density coated Microlite; Pittsburgh Plate Glass, Superfine 0.7 kg density coated interior duct insulation; or equal.

Adhesive.--

Adhesive shall be non-flammable type: Benjamin Foster Company, No. 85-20 Spark Safe; Goodloe E. Moore Company, Tuff Bond No. 6; Permacel, No. PA-3l0; 3M, No. 38 Insulation Adhesive; Swift's, No. 7228 brush type or No. 7336 spray type; Chicago Mastic, 17-461; or equal.

Studs.--

Studs shall be cement-in-place type, pneumatic driven type or percussive welding type, and shall have 25 mm minimum diameter washers.

Insulation inserts.--

Insulation inserts at pipe hangers supports for pipes NPS 2 or larger shall be calcium silicate, cellular glass, or other acceptable material of the same thickness as the adjacent insulation and not less than 6 kg density.

PART 3.- EXECUTION

INSTALLATION.--

General.--Insulation materials shall be neatly installed with smooth and even surfaces, jackets drawn tight and smoothly cemented down.

Insulation material shall not be installed until all pipes or surfaces to be covered are tested for leaks, cleaned and dried, and foreign materials, such as rust, have been removed.

Piping insulation.--Piping insulation shall be in accordance with the following, except that unions, unless integral with valves, and flexible connections shall not be insulated.

a. Where insulation butts against flanges or is discontinued, insulation shall be tapered to pipe to allow for covering jacket to completely seal off end of insulation.

   Insulation shall be extended on the valve bodies up to the valve bonnet.

   Extend insulation continuous through pipe hangers and pipe sleeves. At hangers where pipe is supported, provide an insulated protection shield.

   Insulating cement shall be applied to fittings, valves, and strainers and troweled smooth to thickness of adjacent covering. Strainer cleanout plugs shall remain accessible. Covers fabricated from molded pipe covering may be used in lieu of cement, provided covers are neat and well secured.

b. Jacket flap shall be sealed down with factory applied self-sealing lap. Seams shall be lapped not less than 40 mm. Jacket shall be secured with aluminum bands installed at 300 mm centers.

c. Exposed outdoor insulation shall have an additional 0.40 mm minimum thickness aluminum jacket applied over the completed insulation. The jacket shall have a factory applied moisture barrier and shall be Childers; Smith; or equal.

   End joints shall be lapped with aluminum holding traps located directly over the lap. Additional aluminum holding straps shall be placed at 200 mm centers. Jacket at ells and tees shall be mitered, or premanufactured fitting jackets shall be provided, with additional aluminum holding bands, as required. All joints shall be sealed watertight using silicon type, heat resistant sealant.

d. In-ground insulation shall have an additional PVC jacket applied over the completed insulation and vapor barrier. PVC jacket shall be made water with adhesive or sealant as recommended by the PVC jacket manufacturer.

Alternate pipe insulation, where used, shall be installed on hot water piping before connections are made or the insulation may be slit lengthwise, applied to pipe and sealed with adhesive.

Pipe safety insulation.--Pipe safety insulation shall be installed in accordance with the manufacturer's recommendations.

Duct insulation.--Ragged edges shall be repaired or taped. Coverings shall be neatly finished at joints and edges. Each joint shall have a 50 mm minimum lap.

Where transitions are made between externally covered ducts and lined ducts, the lined duct shall be overlapped 200 mm with external covering.

Insulation shall be flush with but not cover control devices, damper controls or access doors.

Before insulation is wrapped around concealed ducts, an adhesive shall be spot applied at a maximum of 100 mm centers on each side of the ducts to prevent sagging of the insulation. Insulation shall be wrapped entirely around the ducts and shall be wired securely in place with No. 16 copper clad wire, metal bands at least 10 mm wide or plastic ties. Supports shall be spaced a maximum of 300 mm on centers. Metal bands shall be installed with the use of a banding machine. Seams in the insulation shall be taped.

The finished insulation covering shall be even and level and shall not contain humps.

Plenum and duct liner.--Plenums and exposed ducts shall be lined with plenum and duct liner. Plenums and ducts shall be sized to provide the clear inside dimensions shown on plans after the liner is installed .

The insulation shall be applied with coated side exposed to air stream to prevent surface erosion.

The lining shall be fastened in place with adhesive and with studs with washers spaced a maximum of 500 mm on center each way.

Applying adhesive.--The adhesive shall be liberally applied over entire interior surfaces of ducts or plenums.

Stud installation.--Studs shall be installed as follows:

a. Cement-In-Place Type Studs.--Cement-in-place type studs shall be cemented in place with adhesives manufactured for this purpose and shall be as recommended by the stud manufacturer. Cement-in-place type studs shall be used where concrete walls form part of plenum.

b. Percussive Welding Type Studs.--Percussive welding type studs shall be carefully welded in place with current settings that will not appreciably burn galvanizing on opposite side of the sheet metal.

c. Pneumatic Driven Type Studs.--At locations where pneumatic driven type studs are used, hardened steel backup plates or dollies shall be used under the sheet metal.

12-15.04 PLUMBING FIXTURES

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing plumbing fixtures in accordance with the details shown on the plans and these special provisions.

PART 2.- PRODUCTS

General.--Plumbing fixtures shall be white in color and shall meet the following requirements:

Water closet (disabled accessible, 6 liters per flush, floor mounted with tank).--

Disabled accessible water closet shall be 6 liters per flush maximum, vitreous china, siphonable jet, 410 mm to 440 mm high elongated bowl, close coupled tank, floor mounted, with solid plastic open front elongated seat with check hinges. Water closet shall meet or exceed Americans with Disabilities Accessibility Act Guidelines (ADAAG) and ANSI Standards: A117.1 and A112.19.2. Closet and accessories shall be of the following types or equal:

	American Standard	Crane	Universal Rundle
Closet	"Cadet 17 EL1.6/PA" 2168.100 or 4086.800	"Hymont" 3-154E or 3-152 with3-655	"Atlas 1.5" UR 4078-341 or UR 4078-342
Seat	Church 5321.070	Olsonite 95	Benke 527

Water closet (6 liters per flush, floor mounted with tank.).--

Water closet shall be 6 liters per flush maximum, vitreous china, siphon jet, elongated bowl, close coupled tank, floor mounted, with solid plastic open front elongated seat with check hinges. Tank shall be water pressurized air reservoir type. Water closet shall meet or exceed ANSI Standard: A112.19.2. Closet and accessories shall be the following types or equal:

	American Standard	Crane	Kohler
Closet	"Cadet EL 1.6/PA" 2292.100	"Economiser" 3-604	"Wellworth" K-3458
Seat	Olsonite 95	Church 5321.070	"Lustra" K-4670-C

Urinal.--

Urinal shall be vitreous china, wall hung, washout, 20 mm top spud, integral shields, spreader and trap. Urinal and valve shall be of following types or equal:

	American Standard	Crane	Kohler
Urinal	"Washbrook" 6501.010	"Cromwell" 7-187	"Bardon" K-4960-T
Flush valve	Exposed, diaphragm type, chrome plated, with oscillating handle, integral control stop, adjustable tail piece and vacuum breaker suitable for use with 20 mm spud urinals.		

Urinal (disabled accessible).--

Urinal shall be vitreous china, wall hung, siphon jet or washout, top spud, integral shields, spreader and trap, with 380 mm maximum extension from wall. Urinal and valve shall meet Americans with Disabilities Accessibility Act Guidelines (ADAAG) and shall be of following types or equal:

	American Standard	Crane	Kohler
Urinal	"Allbrook" 6540.017	"Manhattan" 7-109	"Bardon" K-4960-T
Flush valve	Exposed, diaphragm type, chrome plated, with oscillating handle, integral control stop, adjustable tail piece and vacuum breaker suitable for use with top spud urinals.		

Lavatory (wall-mounted).--

Lavatory shall be vitreous china, with back, integral perforated grid drain, drilled for 102 mm centers, size 508 mm x 457 mm, with single extra long lever mixing faucet and chair carrier with concealed arms. Lavatory and accessories shall be of the following types or equal:

	Eljer	Crane	Kohler
Lavatory	"Lucerne" 0355.012	"Norwich" 1-194-V	"Greenwich" K-2032
Drain	--	C-1065-G or Moen 52659	K-7715
Supplies	Brass Craft FR1711C	C-1151 or Moen 52664	K-7605
Faucet	2385.130	Moen 8400	K-15592-5
Trap	32 mm chromium plated brass exposed bent tube adjustable 1.37 mm (17-gage) minimum thickness.		
Carrier	Concealed wall mounted carrier with leveling screws and locking devices; Zurn, J.R. Smith, Josam, Wade, Jonespec, or equal.		

Mop sink.--

Mop sink shall be acid resisting enameled cast iron, 711 mm x 711 mm outside dimensions, 75 mm trap, vinyl coated rim guard, vacuum breaker faucet with hose and wall hook. Sink and accessories shall be of the following types or equal:

	American Standard	Eljer	Kohler
Mop sink	"Florwell" 7740.020	"Custodial" 242-0050	"Whitby" K-6710
Strainer	7721.038	803-0630	K-9146
Faucet	8344.111	749-1450	K-8928

Water heater (electric).--

Water heater shall be minimum capacity as shown on plans, designed for minimum 860 kPa, interlocking (non-simultaneous) or single element, glass lined, and equipped with magnesium anodes, cold water drop tube, high temperature energy shut-off device, valved drain, high density R-1.4 K• m^2/W minimum foam insulation and finished with a steel jacket with baked enamel finish. Water heater shall meet the requirements of the California Energy Commission.

Water heater shall be equipped with an ASME labeled, tank mounted, pressure and temperature relief valve sized for maximum input.

Water heater (gas).--

Water heater shall be LPG, minimum capacity as shown on plans, designed for minimum 860 kPa, glass lined, and equipped with gas pressure regulator, magnesium anodes, cold water drop tube, high temperature energy shut-off device, valved drain, high density R-1.4 K• m^2/W minimum foam insulation and finished with a steel jacket with baked enamel finish. Water heater shall meet the requirements of the California Energy Commission.

Water heater shall be equipped with an ASME labeled, tank mounted, pressure and temperature relief valve sized for maximum input.

Emergency eyewash and shower.--

Emergency eyewash and shower shall be separate drench shower and eye bath, 32 mm minimum, galvanized steel pipe stand with 229 mm floor mounting flange and equipped with 216 mm x 279 mm pictorial and worded emergency identification sign.

Shower head shall have a 254 mm diameter ABS plastic head with a stay-open ball valve operated by a rigid pullrod with triangular handle.

Eyewash shall have a 254 mm diameter stainless steel bowl, anti-surge heads and circular chrome plated spray ring to bathe the entire face, dust cover assembly, and a stay-open ball valve operated by a flag handle. Eyewash unit shall be mounted on the shower pipe stand.

Emergency eyewash and shower shall be Haws, 8346; Speakman, SE-607; Western, 9231; or equal.

PART 3.- EXECUTION

INSTALLATION.--

General.--All finish for exposed metal on any fixture, including wall flanges, bolts, nuts and washer, shall be polished chrome plated.

Fixtures shall be sealed to wall or floor with silicone caulk bead.

All exposed metal surfaces on fixture supports shall be enameled to harmonize with fixtures.

Wall mounted fixtures shall be installed on concealed chair carriers designed to support weight of fixture from the floor, made for the specific fixture to be supported and for the particular installation conditions.

All fixtures, including showers, shall be provided with accessible metal stop valves.

Hot water supply, trap and tailpiece on lavatories shall be wrapped with insulating material.

Flush valves for fixtures designated on the plans as disabled accessible shall be installed so that the valve handle is on the widest side of the toilet space.

FIXTURE MOUNTING HEIGHTS.--

General.--Unless otherwise noted, fixtures shall be mounted at the heights shown on the plans.

Mop sink.--Mop sink double faucet shall be mounted on wall above sink back with spout outlet face one meter above the floor.

Water heater.--Water heater shall be installed with seismic restraints, inlet ball valve and insulating connections, and 20 mm pressure and temperature relief drain pipe.

Emergency eyewash and shower.--Emergency eyewash and shower shall be installed with a rigid bracket located 1.2 m above the floor. Bracket shall be minimum 1.52 mm (16-gage) steel and shall be braced to the wall.

FIELD QUALITY CONTROL.--

Testing.--The Contractor shall test piping in accordance with the requirements specified elsewhere in these special provisions.

All installed fixtures shall be tested for proper operation after all plumbing work has been completed.

12-15.05 WHEELCHAIR ACCESSIBLE SHOWER UNIT

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing a wheelchair accessible shower unit and fittings in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data, installation instructions and color palette shall be submitted for approval. The color will be selected from the manufacturer's standard product line by the Engineer after approval of the contract.

QUALITY ASSURANCE.--

Codes and standards.--Shower units shall conform to the requirements of the California State Accessibility Standards contained in the California Building Standards Code, Title 24.

PART 2.- PRODUCTS

Shower stall.--

Shower stall shall be single unit, single piece construction with nominal dimensions of 1525 mm wide, 760 mm deep, and no obstruction at the threshold. Shower stall shall be fabricated from gel-coated fiberglass or acrylic with a Class I Flame Spread. Shower unit shall be reinforced to accommodate the grab bars and seat.

Shower unit shall have a threshold or recessed drop, a maximum of 13 mm in height, sloped at an angle not exceeding 45 degrees from the horizontal. The floor shall be slip-resistant, sloping a maximum of 4 percent to a drain located near the rear wall.

Shower unit shall be provided with the following fittings and accessories: stainless steel corner grab bar and folding phenolic wheelchair transfer seat, each capable of resisting 1112 N of lateral, vertical and tensile load, stainless steel soap dish, chromium plated or stainless steel curtain rod, chromium plated steel hand-held shower head with ball joint, chromium plated 1525 mm long flexible shower spray hose, chromium plated fixed shower head, chromium plated metal outlet drain with removable strainer, chromium plated single lever control thermostatic mixing valve with control cartridge with no metal to metal wearing surface, a lever operated shower head selector, and vinyl shower curtain with corrosion resistant hooks.

Shower stall unit shall be Crane; Florestone; or equal.

PART 3.- EXECUTION

INSTALLATION.--

General.--Shower shall be installed according to the manufacturer's instructions. All joints shall be sealed and caulked watertight.

12-l5.06 LIQUEFIED PETROLEUM GAS (LPG) SYSTEM

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing a liquefied petroleum gas (LPG) distribution system in accordance with the details shown on the plans and these special provisions.

The LPG distribution system shall include an LPG storage tank, LPG vaporizer, pipe, fittings, valves and such other system components necessary for the proper installation and operation of the LPG system.

Permits.--The Contractor shall obtain the required permits to operate pressure vessels in accordance with the requirements of the State Division of Industrial Safety (DIS), shall pay the costs for such permits and shall perform all required tests. Such permits shall be posted under glass at the site of the work.

QUALITY ASSURANCE.--

Codes and standards.--All work performed and materials installed shall conform to the California Building Standards Code, Title 24, Part 4 and Part 5; the California Code of Regulations, Title 8, Chapter 4, Subchapter l, Article 5; and National Fire Protection Association Standard No. 58.

PART 2.- PRODUCTS

Tank.--

Tank shall be constructed and stamped for 1730 kPa working pressure in accordance with the ASME Code for "Unfired Pressure Vessels for Petroleum Liquids and Gases." Tank shall have certification of testing for 2590 kPa. Tank shall include a rainhood with top opening for relief valve and welded steel supports with provisions for bolting to the concrete foundation. Tank shall be shop prime painted with 2 coats of red oxide ferrous metal primer. Primer shall not contain lead pigments.

Tank valves, fittings, regulators and accessories.--

Tank valves, fittings, regulators and accessories shall be UL listed and labeled. Valves, fittings, regulators and accessories shall be as required by the California Codes listed above and shall be Rego, Fisher, Rockwell, or equal.

Pipe and fittings (at the tank and underground).--

Pipe and fittings shall be as specified under "Pipe, Fittings and Valves" in Section 12-15, "Mechanical," of these special provisions. Piping below grade shall be factory coated.

Warning signs.--

Warning signs shall be sheet aluminum, not less than 1.2 mm thick (18-gage) with a baked enamel coating and shall have red letters on a white background.

Vaporizer (direct fired).--

Vaporizer shall be direct-fired type sized as shown on the plans. Vaporizer shall include as ASME stamped pressure vessel, automatic igniter, and all valves and controls required for proper operation. Vaporizer shall be Ransome, Algas-SDI, or equal.

PART 3.- EXECUTION

INSTALLATION.--

General.--The LPG tank and system components shall be installed in accordance with NFPA standards, the manufacturer's instructions and the approved installation drawings.

Foundation.--The tank shall be installed on a concrete foundation. The tank installation shall include seismic restraint and provisions for expansion and contraction. Neoprene or asphalt impregnated felt anti-corrosion pads shall be installed between the saddle and the concrete foundation.

The concrete foundation shall be constructed in accordance with the requirements specified for minor work under "Cast-In-Place Concrete" in Section 12-3, Concrete and Reinforcement," of these special provisions.

All openings shall be capped until ready for field connections. Piping shall be supported adequately, with allowance for swing joint movement.

Piping installation.--Piping shall be buried 900 mm minimum depth and shall be provided with cathodic protection. Insulating unions shall be installed at least 150 mm above grade between the coated pipe and the above ground pipe lines.

Joints for underground piping shall be cleaned, primed and wrapped in accordance with the requirements specified under "Pipes, Fittings and Valves" in Section 12-15, "Mechanical," of these special provisions. The cleaning, priming and wrapping of pipe joints shall be completed after testing the piping system.

Cathodic protection shall be installed in accordance with the details shown on the plans and the requirements specified under "Cathodic Protection" in Section 12-15, "Mechanical," of these special provisions.

Coated pipe inspection.--The coating on all coated pipe shall be inspected for flaws prior to any testing, and shall be reinspected after testing and before the cleaning, priming and wrapping of the joints.

Finish painting.--After installation of the tank, all areas where the shop applied primer has been damaged or has deteriorated shall be thoroughly cleaned and spot painted with primer. Spot painted areas shall be approved by the Engineer prior to the application of the finish coats.

Two applications of the finish coating shall be applied to shop primed steel surfaces exposed to view after the erection of the tank has been completed. The finish coating shall be white gloss, exterior, alkyd enamel.

The word "FLAMMABLE" shall be painted on each side of the tank. Sign lettering shall be standard-type not less than 100 mm in height. The lettering color shall be red and shall be in sharp contrast to the color of the tank.

Warning sign installation and application.--Three warning signs with the words "NO SMOKING, OPEN FLAMES OR OTHER SOURCE OF IGNITION PERMITTED WITHIN 15.2 METERS (50 FEET)" shall be placed at the locations shown on the plans. Sign lettering shall be standard-type not less than 38 mm in height. The lettering color shall be in sharp contrast to the color of the sign.

FIELD QUALITY CONTROL.--

Testing.--After construction, installation and pipe testing, the LPG system shall be pressure tested with air or nitrogen. The system shall be tested for a minimum time period of 30 minutes at 1380 kPa. If any leaks are detected during the test, the system shall be repaired and retested until no leaks are detected.

After the pressure tests have been completed, the LPG system shall be purged 5 times with methanol (methyl alcohol), using one-liter per 1000 liters water capacity, to remove moisture from the system.

After testing and purging the system, the tank shall be filled to 25 percent of the water capacity of the tank, measured in liters, with State-furnished LPG as provided under "State-Furnished Materials" in Section 8, "Materials," of these special provisions.

An operational test shall be performed on the LPG system upon completion of the pressure tests, the purging of the system and the delivery of the State furnished LPG fuel. The operational test shall consist of operating all LPG equipment for a period of three 24-hour days.

12-15.07 HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT AND SYSTEMS

PART 1.- GENERAL

Scope.--This work shall consist of furnishing, installing and testing heating, ventilating and air conditioning (HVAC) equipment and systems in accordance with the details shown on the plans and these special provisions.

The performance rating and electric service of the HVAC equipment shall be as shown on the plans.

Temperature controls.--Thermostats, relays, timer switches, and other sensor type control devices required for this work shall be furnished and installed by the supplier of the heating, ventilating and air conditioning equipment. All temperature control wiring shall be furnished and installed in accordance with the requirements specified in Section 12-16, "Electrical," of these special provisions.

Codes and standards.--Equipment and systems shall conform to California State Energy Commission Regulations and, where applicable, shall be American Refrigeration Institute (ARI), American Gas Association (AGA), Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA), and Air Movement and Control Association (AMCA) approved for performance ratings and application shown on the plans.

Any appliance for which there is a California standard established in the Appliance Efficiency Standards may be installed only if the manufacturer has certified to the Commission, as specified in those regulations, that the appliance complies with the applicable standards for that appliance. Space conditioning equipment may be installed only if the manufacturer has certified that the equipment meets or exceeds all applicable efficiency requirements listed in the Energy Efficiency Standards.

PART 2.- PRODUCTS

HEATING AND COOLING UNITS.--

Furnace.--

Furnace shall be gas fired, sealed combustion system, induced draft, high efficiency, furnace. Furnace shall be AGA approved for LPG, shall be equipped with electronically controlled blower and hot surface ignition. Furnace cabinet shall have an enamel finish and the primary and secondary heat exchangers shall be corrosion resistant construction. Blower shall be vibration-isolated.

The fan and fan motor shall provide the specified air circulation, with filters, against external static pressure as shown on the plans.

Furnace shall have multi-speed fan motor with thermal overload protection and shall be factory wired for a single power connection, including provisions for optional air conditioning, and low voltage control circuit with a terminal board.

Split system furnace/air conditioner shall include a cased evaporator coil, a remote outdoor condensing unit and economizer. Indoor evaporator coil shall be a factory assembled unit by the forced air furnace equipment manufacturer. Furnace and cased coil unit shall be designed to mate with each other. Unit shall be provided with a refrigerant metering device and corrosion-resistant condensate drain pan with drain connections. The wetted coil air friction shall not exceed 75 Pa. The cased coil unit shall have the same finish as the furnace.

Refrigerant lines and condensate drain piping shall be as specified elsewhere in these special provisions.

Outdoor condensing unit shall be same manufacturer as indoor unit; air cooled, factory assembled, charged and tested, and wired for single point power and control connections. Unit shall be enclosed in a weatherproof acoustically lined cabinet with access panels and a baked-on enamel finish. The compressor shall be the hermetically sealed type, and shall be provided with quick start components, pressure relief valve, high and low pressure switches, liquid-line filter-dryer, crankcase heater, short cycling protection, and service valves.

Evaporative cooler.--

Evaporative cooler shall be a factory assembled unit having removable side panels with filters and a bottom drain. The cabinet shall be fabricated from galvanized steel sheet metal with a baked-on enamel finish. Interior surfaces of the cabinet bottom shall be asphalt coated. The drain fitting shall be threaded for connection to drain piping.

All parts of the float valve and recirculating pump, which come into contact with water, shall be of stainless steel or other corrosion resistant material.

Unit heater.--

Unit heater shall be gas-fired, propeller fan type, AGA approved for LPG and shall be equipped with aluminized steel heat exchanger, built in backdraft diverter, fan switch marked "SUMMER"-"WINTER," adjustable discharge louvers, gas pressure regulator, intermittent ignition device, gas main and pilot shutoff valves, automatic gas valve, high limit shutoff, 24-volt transformer, and fan motor local disconnect. All components shall be factory assembled. Unit heater shall be Reznor; Modine; Hastings; or equal.

Unit heater fan motor shall have integral thermal overload protection.

Electric wall heater.--

Electric wall heater shall be radiant, surface mounted type, and shall be equipped with a grille and integral thermostat.

FANS AND VENTILATORS.--

Supply fan (in-line).--

Supply fan shall be ducted in-line, AMCA certified and shall be equipped with grille, backdraft damper and metal housing. Supply fan motor shall have integral thermal overload protection and local disconnect. Supply fan shall be Greenheck, Carnes, or equal.

Declassification fan (wall mounted).--

Declassification fan shall be wall mounted, belt-driven, centrifugal type, AMCA certified.

Fan motor and fan assembly shall be isolated from base with rubber vibration isolators. Fan motor shall be 3-phase, continuous duty and explosion proof with integral thermal overload protection.

Wall declassification fan shall be supplied with wall mount collar, spark-resistant fan wheel, aluminum housing, backdraft damper and weatherhood. Weatherhood shall be galvanized steel with bird screen. All parts shall be supplied by the fan manufacturer. Declassification fan shall be Greenheck, Carnes, or equal.

Combination heat/vent/light.--

Combination heat/vent/light shall be ceiling mounted, recessed type unit with metal housing, grille and backdraft damper. Ducting size shall be as required by the manufacturer. Unit shall be provided with a 75-watt flood lamp and 250-watt RUO infrared lamp. Combination heat/vent/light shall be Broan, No. 655; Nutone, No. 665N; or equal.

Exhaust fan (roof-mounted).--

Exhaust fan shall be AMCA certified and shall be equipped with metal housing, centrifugal fan wheel, backdraft damper and bird screen. Fan motor and fan assembly shall be isolated from base with rubber vibration isolators. Fan motor shall have integral thermal overload protection. Exhaust fan shall be completely weatherproof and shall have a disconnect means under the hood. Roof curb shall be insulated and shall be supplied by the fan manufacturer. Exhaust fan shall be Greenheck, Carnes, or equal.

HVAC CONTROLS.--

Unit heater thermostat.--

Unit heater thermostat shall be low voltage type, single set point range internally adjustable from 4°C to 27°C, and provided with a blank cover.

Thermostat (office only).--

Thermostat shall be 24-volt, 7-day programmable, electronic heating/cooling thermostat, with the ability to program the fan-on mode during normal working hours, and fan-off mode during unoccupied periods. Thermostat shall be provided with sub-base selector switches for "AUTO-HEAT-OFF-COOL" and fan "AUTO-ON". Thermostat shall be auto-changeover type, and have full temperature range setback capacity. Thermostat shall be Robertshaw, 7900; Honeywell, T7300; or equal.

Time switch.--

Time switch shall be one-hour, spring-wound, "OFF" type time switch without a "HOLD" feature. Time switch shall be Intermatic, Type F60M; Tork, A500 Series; or equal.

AUXILIARY HVAC COMPONENTS.--

Unless specified herein, all components shall be sized and have the characteristics as shown on the plans.

Rigid ductwork.--

Rigid ductwork shall be galvanized steel sheet metal conforming to the latest edition of the SMACNA "Low Velocity Duct Construction Standards." Galvanized steel shall be cleaned by washing with mineral spirit solvent sufficient to remove any oil, grease or other materials foreign to the galvanized coating.

Spiral duct.--

Spiral duct shall be prefabricated type.

Duct supports.--

Duct supports shall be hot-dip galvanized steel.

Flexible ductwork.--

Flexible ductwork shall be UL 181, Class 1 air duct rated and shall meet the requirements of NFPA 90-A. Duct shall have steel helix wire, flexible insulation, minimum thermal resistance of R-0.7 (m^2*K/W), and flame resistant vapor barrier. Inner and outer surfaces shall be non-metallic. Outer surface shall be Copolymer or Mylar, factory applied.

Flexible connection.--

Flexible connection shall be prefabricated type and shall be commercial quality flexible glass fabric coated on both sides with neoprene or hypalon.

Ceiling diffuser (for gypsum board ceilings).--

Ceiling diffuser for gypsum board ceilings shall be rectangular or square type. Diffuser shall be steel with oven baked-on enamel bone white dull finish or extruded aluminum, equipped with a removable core and a standard flanged frame with sponge rubber or felt gasket. Diffuser shall have individually adjustable curved blades, counter-sunk screw holes, shall be surface mounted, with face velocity less than 3.05 m/s; Titus, 250; Air Mate, 400-O; Hart and Cooley, A40; or equal.

Return register (for gypsum board ceilings).--

Return register for gypsum board ceilings shall be rectangular or square, and shall be steel with oven baked-on enamel bone white dull finish or extruded aluminum, fixed bar type, die formed louvers set at 45 degrees, 13 mm spacing maximum, surface mounted; Titus, 335; Air Mate, 280; or equal.

Plenum supply register.--

Plenum supply register shall be double-deflecting adjustable type, with vertical face bars and horizontal rear louvers, steel with oven baked-on enamel bone white finish or extruded aluminum, flanged frame with sponge or felt gasket; Hart and Cooley T62; Air Mate 240-HO or equal.

Volume damper.--

Volume damper shall be opposed blade type, operable from face with screw driver or Allen-head wrench, shall be same manufacturer as diffuser or may be furnished as part of the diffuser.

Fire damper.--

Fire damper shall be approved or listed by the State Fire Marshal. Each fire damper shall have an approved fusible link with a temperature rating 10°C. above normal maximum operating temperature, and precision machined bronze sleeve type bearings. Fire damper shall have all steel parts factory painted with an oven baked-on metal primer and enamel finish. Fire damper shall be dynamic-rated and have a velocity rating as shown on the plans.

Balance damper.--

Balance damper shall be butterfly type, 1.52 mm (16-gage) minimum galvanized steel blade, end bearings with steel shaft and locking and indicator operator. Balance damper shall be Ventlock, Young, Anemostat, or equal.

Vents and flues (for heaters).--

Vents and flues for heaters shall be approved Type B.

Refrigerant and condensate drain piping.--

Refrigerant and condensate drain piping shall be rigid, Type L copper tubing with brazed solder fittings. The suction line shall be insulated, with vapor barrier and shall be weatherproofed for exterior installation. Factory sealed tubing shall not be used.

PART 3.- EXECUTION

INSTALLATION.--

Heaters.--Furnaces, unit heaters, and wall heaters shall be installed in such a manner as to insure adequate furnace clearance and separation of combustion air and circulating air. Appliances shall be connected to a rigidly mounted gas pipe supply system by an AGA approved flex connector and gas valve.

Ventilators--Exhaust ducts connected to exhaust fans shall be routed as shown on the plans and shall terminate in a weatherproof cap. Duct sizes shall be as shown on the plans or as recommended by the manufacturer, whichever is larger.

Roof fans shall be curb mounted.

Condensate drains.--Air conditioning units shall be provided with condensate drain trap and piping. Air gap shall be installed where required by code. Interior condensate drain piping shall be insulated with foam insulation.

Evaporative cooler.--Evaporative cooler shall be provided with drain piping routed to within 150 mm of the ground.

Mounting heights.--Thermostats and time switches shall be installed as shown on the plans.

Temperature controls.--Temperature control for each unit heater shall be provided by 2 low voltage thermostats and a time switch. One thermostat shall be set at 7°C. for low-limit temperature control and the second thermostat shall be set at 21°C. The first thermostat shall energize the heater whenever the temperature is below the setpoint. The second thermostat shall be wired in series with the time switch and shall de-energize the heater above the setpoint.

Each thermostat shall be insulated from the outside walls, and shall be provided with an aluminum radiation shield above the thermostat.

The time switch shall be installed beside the thermostat or where shown on the plans.

Air outlets.--Volume dampers shall be furnished and installed for all diffusers. Blocking shall be provided on all sides of air outlets between ceiling or wall joists. Collars shall be supplied for all outlets and shall be taped and sealed in place.

Vents and flues.--Vents and flues shall be securely fastened to the building construction, shall be provided with a collar at all ceiling penetrations and shall terminate with a weather cap fabricated of the same material.

Access door.--Access doors shall be provided in rigid ducts and plenums for access to volume dampers, fire dampers and control devices located within such ductwork; and shall be provided at such other locations as shown on the plans.

Ducts and vents.--Ductwork within the building shall be installed to clear lighting fixtures, doors, windows and other obstructions. Ductwork shall preserve head room and shall keep openings and passageways clear whether shown on plans or not.

Ductwork shall be installed and braced according to the latest edition of the SMACNA "HVAC Duct Construction Standards."

Slopes in sides at transitions shall be approximately one to five. The ductwork system shall not contain abrupt changes or offsets of any kind unless otherwise shown on the plans.

Where ducts pass through walls, floors or ceilings, galvanized sheet metal or steel angle collars shall be installed around the ducts.

Duct sections shall be connected by beaded sleeve-type couplings using joint sealer as recommended by the duct manufacturer. Duct sections shall be mechanically fastened with pop rivets or sheet metal screws and sealed with mastic or insulated, reinforced silver tape.

Flexible connections shall be provided at both inlet and outlet of fan coil and ventilating units.

Sheet metal plenums shall be adequately braced and supported from the floor or structure with structural steel angles to prevent sagging, flexing and vibration.

All standing seams and transverse joints of supply, return and exhaust ducts and seams around plenums, fan and coil housings shall be sealed with sealant and taped.

Duct penetrations in fire rated assemblies.--Where ductwork passes through fire rated wall, floor or ceiling assemblies, the penetration shall be protected in accordance with the requirements specified under "Through-Penetration Firestopping" in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

FIELD QUALITY CONTROL.--

Pre-test requirements.--Before starting or operating systems, equipment shall be cleaned and checked for proper installation, lubrication and servicing.

In each system, at least one air path, from fan to final outlet, shall have all balance dampers open. The final air quantities shall be achieved by adjusting the volume dampers or the fan RPM.

Final adjustments and balancing of the systems shall be performed in such a manner that the systems will operate as specified and as shown on the plans.

The Contractor shall replace or revise any equipment, systems or work found deficient during tests.

All automatic operating devices which are pertinent to the adjustment of the aforementioned air systems shall be set and adjusted to deliver the required quantities of air and at temperatures specified by the Engineer. All control work shall be done in collaboration with the control manufacturer's representative.

Project completion tests.--The Engineer shall be notified at least 3 working days in advance of starting project completion tests.

The project completion tests shall consist of the following:

1. **Air Systems.--**All air systems shall be tested and balanced to the conditions set forth on the plans and in these special provisions. This work shall be performed by an Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB) certified contractor. The air systems include, but are not necessarily limited to, the following:

    a. Supply air systems
    b. Return air systems
    c. Exhaust air systems

2. **Operational Data.--**The tests shall include operation of the heating, cooling, and ventilating systems for not less than two 8-hour days, each system shall operate at not less than 90 percent of their full specified capacities.

   The required data shall be accurately measured. The data shall be measured during one operational cycle in the presence of the Engineer and shall be submitted for approval.

   The following data shall be measured and tabulated:

   a. Ambient temperatures and conditions, °C
   b. Supply and return air quantities, L/sec, each room
   c. Thermostat set point, °C
   d. Air temperatures at room center, °C
   e. Fan motor amperages and voltages
   f. System static pressures, Pa

12-15.08 HYDRONIC HEATING SYSTEM

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing, installing and testing a hydronic heating system in accordance with details shown on the plans and these special provisions.

Piping, tubing and valves for hydronic heating shall conform to the requirements in "Pipe, Fittings, and Valves," elsewhere in this Section 12-15.

Thermostats, relays, time switches, and other sensor type control devices required for this work shall be furnished and installed by the supplier of the heating, ventilating and air conditioning equipment. All temperature control wiring shall be furnished and installed in accordance with the requirements specified in Section 12-16, "Electrical," of these special provisions.

QUALITY ASSURANCE.--

Codes and standards.--Equipment and systems shall conform to California State Energy Commission Regulations and, where applicable, shall be American Refrigeration Institute (ARI), American Gas Association (AGA), Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA), and Air Movement and Control Association (AMCA) approved for performance ratings and application shown on the plans.

PART 2.- PRODUCTS

COMPONENTS.-

Pumps.--

Pumps shall be cartridge-type circulators with non-overloading characteristics. Pumps shall not overload the motor above its horsepower rating under any operating conditions with the ratings based on continuous operation. Motor sizes shown are estimated minimum requirements and larger motors shall be furnished if necessary to meet non-overloading requirements. Motors shall have built-in overcurrent protection.

Pump material shall be compatible with the working fluid, and shall be sized to meet the operating requirements specified.

Pumps shall not be connected to the piping before the piping is thoroughly flushed and cleaned of dirt and grit. After the connections have been made, the system shall be filled before starting the pumps. Pumps shall not be run dry under any circumstances.

Piping shall be supported from the building structure to prevent strain on the pump casings. A final check for alignment of the piping connections shall be made after the pump has been secured.

Chemical feeder.--

Chemical feeder shall be bypass feeder, pot type with 3.79 L minimum capacity. Feeder shall be provided with union and ball valve on both the supply and return lines, configured as recommended by the manufacturer.

Heat exchanger.--

Heat exchanger shall be counterflow, plate type with channel, cover plates and connection fittings constructed of Type 316 stainless steel. The heat exchanger shall be rated for a working pressure 550 kPa and rated for a temperature of at least 150°C, and sized according to the plans.

Expansion tank.--

Expansion tank shall be of welded steel construction and shall be ASME inspected and stamped for 860 kPa working pressure. The tank shall be equipped with drain valve, air charging valve, and gauge glass. Expansion tank shall have the capacity shown on the plans.

Gauge glass.--

Gauge glass shall be 12 mm in size and of adequate length to indicate the entire contents of the tank. The gauge shall be an automatic type with drain cock and shall be valved top and bottom to allow changing the glass without draining the tank.

Automatic Air vent.--

Air vent shall be furnished and installed as shown on the plans. Air vent shall be constructed for 860 kPa working pressure.

Flow meter.--

Flow meter shall be in-line, direct reading, see-through type, rated for 82°C temperature and 860 kPa working pressure with accuracy to within 2 percent of full scale reading.

Flow meter shall have a maximum scale range of 100 liters per minute (LPM).

Flow meter shall be Blue-White Industries, Hedland Products, Letro Thermometer Incorporated; or equal.

Thermometer.--

Thermometer shall be liquid dial type, minimum 125 mm diameter, with 1°C graduations and a temperature range that includes 0°C and 100°C.

Accuracy shall be within ± one percent.

Thermometer shall be provided with extension neck or stem such that the thermometer face is above the surface of insulation or other materials.

Liquid thermometer shall be designed for and be installed in a thermowell which projects into the flow stream and is completely immersed in liquid. The thermowell shall prevent system fluid loss when the thermometer is removed. Pipe size shall be increased at the thermowell where necessary to allow for full flow without excessive resistance.

Thermocouple.--

Thermocouple shall be Type J, high temperature, ceramic filter insulated thermocouple with nickel alloy overlaid.

Pressure gage.--

Pressure gage shall be ANSI Standard: B40.1, Grade A, 110 mm minimum diameter dial, liquid filled with cover, plain case, reset screw, 7 mm bottom inlet. Gage shall read from 0 kPa to 550 kPa. Each pressure gage shall be equipped with a gage cock.

Gage cocks.--

Gage cocks shall be 7 mm, brass or bronze, 1040 kPa rated with female and male threaded ends, and tee handle. Gage cocks shall be installed at each pressure gauge.

PART 3.- EXECUTION

INSTALLATION.--

Installation of pipe and tubing.--Installation of all heating water supply and return pipe and tubing shall conform to the requirements for cutting, cleaning, closing, securing and insulating of water piping as specified under "Pipe, Fittings, and Valves," and "Mechanical Insulation," elsewhere in this Section 12-15.

Heating water floor coil layout shall conform to the details shown on the plans. The spacing between tubing runs shall be 300 mm on center. Vertical clearance from the surface of the slab to the tubing shall be as shown on the plans. The minimum radius for tubing bends shall be 150 mm.

Floor coil tubing shall be laid in continuous lengths with no splicing. Tubing shall be secured directly to the bar reinforcement using nylon ties located at 3 m intervals along straight runs, at the mid-point of each radius on bends and at other locations as directed by the Engineer.

The piping system in the floor slab shall be tested prior to placing concrete. The compressor, pump, gauges and other materials or equipment required for testing the piping systems shall be furnished and installed by the Contractor.

The piping shall be visually leak tested with water at 690 kPa for 4 hours prior to the placement of the slab concrete. At the conclusion of the water testing, the floor slab concrete shall be placed. The water pressure shall be maintained in the piping system during the concrete placement operation. Leaks that develop shall be repaired immediately. The water pressure shall be released 2 hours after completion of the concrete placement and repressurization shall not take place until the concrete has attained sufficient strength to resist the piping expansion as determined by the Engineer.

The ends of the in-slab pipe risers shall remain capped and protected from damage. After the above slab portion of the supply and return piping has been installed and tested, both systems shall be flushed with clean, potable water and then connected.

The completed above and below slab systems shall be pressure tested using water pressure at 690 kPa for 8 hours. The system shall show no loss in pressure. At the conclusion of the pressure test, the system shall be filled with a 50-50 solution of glycol and water.

The contractor shall be responsible for freeze protecting all piping prior to the completion of the hydronic system.

FIELD QUALITY CONTROL.--

Pre-test requirements.--Before starting or operating systems, equipment and controls shall be cleaned and checked for proper installation and operation.

Each separate circuit shall have the flows balanced and recorded. The pumping rate for each pump shall be adjusted to the value shown on the plans.

Final adjustments and balancing of the systems shall be performed in such a manner that the systems will operate as specified and as shown on the plans.

The Contractor shall replace or revise any equipment, systems or work found deficient during tests.

All automatic operating devices which are pertinent to the adjustment of the aforementioned system shall be set and adjusted to deliver the required performance at temperatures specified by the Engineer. All control work shall be done in collaboration with the control manufacturer's representative.

Acceptance testing.--Prior to completion of hydronic system installation, and before permitting use of the system, the Contractor shall fire the boiler and demonstrate all operating and safety controls in the presence of the Engineer.

The Contractor shall notify the Engineer at least 3 working days in advance of the dates and times tests are to be performed.

Upon completion of mechanical work and pre-test requirements, or at such time prior to contract acceptance as determined by the Engineer, the Contractor shall operate and test the complete hydronic heating system for at least 5 consecutive 8-hour days to demonstrate satisfactory overall operation.

INSTRUCTION AND MAINTENANCE--

Instruction.--The Contractor shall instruct State personnel in the proper use, operations and daily maintenance of the hydronic heating system, including the boiler.

Emergency provisions, including emergency access and procedures to be followed at time of operational failure and other building emergencies, shall be reviewed.

State personnel shall be trained in normal procedures to be followed in checking sources of operation failures or malfunctions.

Immediately prior to substantial completion, the Contractor shall conduct a final inspection with State personnel present to determine that control systems and operating devices are operating properly.

Project completion tests.--The Engineer shall be notified at least 3 working days in advance of starting project completion tests.

The project completion tests shall consist of the following:

During the test period the following data shall be measured and recorded twice a day:

1. Ambient temperature and conditions.
2. Circulating fluid flow through each pump.
3. Slab and air temperature in the service bays and shop areas.

The measurements shall be taken prior to 8:00 a.m. each morning and after 1:00 p.m. each afternoon.

At the completion of the test period, the flow rates for each individual circuit of the radiant heating system shall be recorded. Flow rate data shall be tabulated and submitted to the Engineer at the jobsite for approval.

12-15.09 BOILER

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing, installing and testing the LPG fired boiler, equipment and systems in accordance with the details shown on the plans and these special provisions.

Temperature controls.--Thermostats, relays, time switches, and other sensor type control devices required for this work shall be furnished and installed by the supplier of the heating, ventilating and air conditioning equipment. All temperature control wiring shall be furnished and installed in accordance with the requirements specified in Section 12-16, "Electrical," of these special provisions.

QUALITY ASSURANCE.--

Installer's qualification.--Installation of the boiler shall be by the boiler manufacturer or a licensee of the manufacturer, who has not less than 5 years successful experience with the installation of similar boilers and who maintains a service facility within 100 km of the jobsite.

Codes and standards.--Equipment and systems shall conform to Uniform Mechanical Code, California State Energy Commission Regulations and, where applicable, shall be American Refrigeration Institute (ARI), American Gas Association (AGA), Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA), and Air Movement and Control Association (AMCA) approved for performance ratings and application shown on the plans.

PART 2.- PRODUCTS

MANUFACTURED UNITS.--

Boiler.--

Boiler shall be a packaged unit, ASME inspected and stamped, UL or FM rated, AGA certified for LPG fuel. The unit shall be a forced draft, intermittent ignition, high-low firing, hot water boiler with 80 percent minimum efficiency, insulated steel jacket and stainless steel positive pressure flue stack with cap.

Boiler shall be rated for 1100 kPa minimum and shall be equipped with a 310 kPa ASME rated pressure relief valve. The boiler operating controls shall allow for interruption of the firing circuit without affecting the safety controls.

The entire unit shall be finished with a rust, corrosion and heat resistant industrial type enamel paint.

The boiler capacity shall be as shown on the plans.

ACCESSORIES.--

Controls.--

The boiler unit shall include the following controls:

Operating low water shut-off
Low water safety fuel shut-off with manual reset
ASME rated relief valve
Adjustable operating control
High limit safety control with manual reset
Pressure gauge and temperature indicator
Flame safety control
Safety pilot control
Flue gas thermometer
Air eliminator
Blow-off valve for bottom blowdown
Gas pressure regulator and shut-off valve
Low pressure and high pressure gas shut-off
Pilot gas pressure regulator and shut-off valve

Expansion tank.--

Expansion tank shall be capacity shown on the plans, of welded construction and shall be ASME inspected and stamped for 860 kPa working pressure. The tank shall be equipped with a drain valve, air charging valve, high level alarm, low level alarm and gauge glass.

Sight gage.--

Site gage shall be 15 mm in size and of adequate length to indicate the entire contents of the tank. Gage shall be an automatic type with drain cock and shall be valved top and bottom to allow changing the glass without draining of the tank.

Boiler test kit.--

Boiler test kit shall be a package unit designed to analyze the boiler combustion by-products. The kit shall have a single probe for insertion into the flue stack and shall be complete with a pump for continuously sampling combustion by-products. All components necessary for the test kit operation shall be contained in a single carrying case. The kit shall be capable of measuring, calculating, displaying and printing out the following values within the range specified:

Oxygen (0 to 25 percent)
Excess air (0 to 250 percent)
Carbon monoxide (0 to 3000 parts per million)
Combustion efficiency (0 to 99.9 percent)
Stack loss (0 to 99.9 percent)
Carbon dioxide (0 to 29 percent)
Flue stack temperatures (0°C to 1093°C)
Oxides of Nitrogen (0 to 2000 parts per million)
Sulfur Dioxide (0 to 2000 parts per million)

Boiler test kit shall be programmed for a least the following fuels: natural gas, No. 2 fuel oil, No. 6 fuel oil, and liquified petroleum gas (LPG).

Boiler test kit shall operate with a dual power capacity by having a rechargeable battery capable of powering the unit for not less than 12 hours of continuous use, and 120 VAC line power.

Boiler test kit shall have 2 flue traps for filtering water, soot, and particulates before they enter the instrument.

Boiler test kit shall have digital LED displays, a real time display of 12 or 24 hours, and an output for personnel computer data transfer.

Boiler test kit shall have a printer capable of printing all calculated and measured values of the combustion process, serial number of unit, time and date of the test, and name of the testing organization. Printer paper shall be standard thermal printer paper.

Boiler test kit shall have self and local diagnostic capabilities, and inform the operator on condition of all sensors during operation. Error codes shall be displayed when sensors require calibration or replacement.

Boiler test kit shall be Bacharach, Enerac, Lynn, Neotronics, Teledyne, or equal.

PART 3.- EXECUTION

INSTALLATION.--

Boiler.--The boiler shall be installed in accordance with manufacturer's recommendations.

The boiler shall be installed to provide the minimum access clearances recommended by the manufacturer for servicing and cleaning. The boiler shall be configured for sidewall venting.

FIELD QUALITY CONTROL.--

Pre-test requirements.--Before starting or operating the boiler, equipment shall be cleaned and checked for proper installation.

All operating controls and safety controls shall be independently checked for proper installation and operation.

Acceptance testing.--Prior to completion of boiler installation, and before permitting use of the boiler, the Contractor shall fire the boiler and demonstrate all boiler operating and safety controls in the presence of the Engineer.

The Contractor shall notify the Engineer and the inspection department of governing agencies in advance of the dates and times tests are to be performed.

Upon completion of mechanical work and pre-test requirements, or at such time prior to contract acceptance as determined by the Engineer, the Contractor shall operate and test installed boiler system for at least 3 consecutive 8-hour days to demonstrate satisfactory overall operation.

Boiler test kit shall be factory calibrated and shall be demonstrated at the jobsite by a factory trained representative in the presence of the Engineer.

INSTRUCTION AND MAINTENANCE--

Instruction.--The Contractor shall instruct State personnel in the proper use, operations and daily maintenance of the boiler.

Emergency provisions, including emergency access and procedures to be followed at time of failure in operation and other building emergencies, shall be reviewed.

State personnel shall be trained in normal procedures to be followed in checking sources of operation failures or malfunctions.

Immediately prior to substantial completion, the Contractor shall conduct a final inspection with State personnel present to determine that control systems and operating devices are operating properly.

Maintenance.--The Contractor shall provide continuing maintenance and inspection of the boiler for a period of one year following completion of the contract.

12-15.10 CATHODIC PROTECTION

GENERAL.--This work shall consist of providing cathodic protection for pipes in accordance with the details shown on the plans and the requirements in these special provisions.

SUBMITTALS.--Descriptive data for anodes, test stations, and fusion welded connections shall be submitted for approval.

PRODUCTS.--

Anodes.--

Anodes shall be magnesium, prepackaged in cloth bags containing hydrated gypsum and bentonite clay; Dow, Galvo Mag; Kaiser, Electromag; or equal.

Anode test station.--

Anode test station shall be conduit mounted non-metallic terminal board with integral compression-fit base and screw on cover. The terminal board shall have nickel plated brass factory installed hardware. The test station shall be fabricated of white polycarbonate.

Conductors.--

Conductors shall be solid No. 12 AWG copper, Type TW or THW, insulation colored black for anode and red for all others.

Fusion weld material.--

Fusion weld material shall be a mixture of copper oxide and aluminum.

EXECUTION.--

INSTALLATION.--Excavation and backfill shall be in accordance with the requirements specified under "Earthwork for Building Work" in Section 12-2, "Sitework," of these special provisions.

Impervious wrapping around the cloth bag packaged anode shall be removed immediately before installing the anode.

Anodes shall be installed at the locations shown on the plans. The packaged anode shall be wetted thoroughly before backfilling. Backfill material placed to 300 mm above the anode shall be native soil, free from aggregate larger than 13 mm in size.

Conductors shall be connected to pipes by fusion welding. Connection to the lift post shall be located to remain visible. All other connections shall be insulated watertight after inspection by the Engineer.

Fusion weld connection to steel surface shall be made of molten copper produced by exothermic reaction following ignition of a mixture of copper oxide and aluminum flowing into weld cavity of a properly fitting graphite mold.

Each pipe conductor shall connect only one pipe to a terminal on the terminal board in the anode test box except where otherwise shown on the plans.

Pipe conductors shall have 300 mm slack at pipe connections and 600 mm slack at the anode test box.

Conductors shall be direct buried and located safe from damage due to construction operations.

All metals connected to cathodic protection, except plastic-coated pipes, shall be tape-wrapped as specified under "Pipe, Fittings and Valves" in Section 12-15, "Mechanical," of these special provisions. Cathodically protected metals shall be isolated from all other metals.

TESTING.--

CATHODIC PROTECTION TESTING.--Cathodic protection systems shall be tested by a corrosion technician certified by the National Association of Corrosion Engineers (NACE). Tests shall include the following:

1. Isolation of protected metal from electrical conduit, piping for water and sewage, fuel island vents, steel the building, or other metals.

   If the same potential is measured from a stationary copper-copper sulphate half cell to any foreign structure as to the protected structure, the protected structure shall be deemed to be metallically connected to the foreign structure and the installation shall be deemed unacceptable.

2. Anode current.

3. Polarized potential.

   An instant-off potential of less then 850 millivolts shall be deemed to indicate an unacceptable installation. The instant-off potential shall be the voltage between the protected structure and a copper-copper sulphate half cell measured after the immediate shift that occurs when anode current is interrupted, but before any further current decay.

4. Anode potential.

   The anode open-circuit potential shall be at least 95 percent of the value listed in the manufacturer's published data for the type of anode furnished.

The tests shall be performed after all reinforcing steel, conduits, pipes and other foreign structures that might be inadvertently connected to the protected structures have been installed and backfilled or encased.

The corrosion technician shall submit a written report certifying the cathodic protection. The report shall indicate each measurement made and its recorded value.

SECTION 12-16. ELECTRICAL

12-16.01 ELECTRICAL WORK

PART 1.- GENERAL

SUMMARY

Scope

This work shall consist of performing electrical work in accordance with the details shown on the plans and these special provisions.

Electrical work shall include furnishing all labor, materials, equipment and services required to construct and install the complete electrical system shown on the plans and the work of installing electrical connections for the thermostats, motors, and controls specified elsewhere in these special provisions.

System layouts are generally diagrammatic and location of equipment is approximate. Exact routing of conduits and other facilities and location of equipment is to be governed by structural conditions and other obstructions, and shall be coordinated with the work of other trades. Equipment requiring maintenance and inspection shall be located where it is readily accessible for the performance of such maintenance and inspection.

Related work

Earthwork, foundations, sheet metal, painting, mechanical and such other work incidental to and necessary for the proper installation and operation of the electrical work shall be done in accordance with the requirements specified for similar work elsewhere in these special provisions.

CLOSEOUT SUBMITTALS

Operation and maintenance manuals

Prior to the completion of the contract, 3 identified copies of the operation and maintenance instructions with parts lists for the equipment specified herein shall be delivered to the Engineer at the jobsite. The instructions and parts lists shall be in a bound manual form and shall be complete and adequate for the equipment installed. Inadequate or incomplete material will be returned. The Contractor shall resubmit adequate and complete manuals at no expense to the State.

Manuals shall be submitted for the following equipment:

Fire alarm control panel
Intrusion alarm control panel
Main switchboard and panelboards
Lift pump station control cabinet
Oil/water separator control panel

QUALITY ASSURANCE

Codes and standards

All work performed and materials installed shall be in accordance with the National Electrical Code; the California Building Standards Code, Title 24, Part 3, "California Electrical Code," and the California Code of Regulations, Title 8, Chapter 4, "Electrical Safety Orders," and all state ordinances.

Warranties and guarantees

Manufacturer's warranties and guarantees for materials or equipment used in the work shall be delivered to the Engineer at the jobsite prior to acceptance of the contract.

TESTING

After the electrical system installation work has been completed, the electrical system shall be tested in the presence of the Engineer to demonstrate that the electrical system functions properly. The Contractor shall make necessary repairs, replacements, adjustments and retests at his expense.

12-16.02 BASIC MATERIALS AND METHODS

PART 1.- GENERAL

SUMMARY

Scope

This work shall consist of furnishing and installing conduits, conductors, fittings, and wiring devices in accordance with the details shown on the plans and these special provisions.

Conduits, conductors, fittings, and wiring devices shall include those accessories and appurtenances, not mentioned, that are required for the proper installation and operation of the electrical system.

Related work

Roof penetrations shall be flashed and sealed watertight conforming to the requirements specified under "Sheet Metal Flashing" in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

Where conduits pass through fire rated wall, floor or ceiling assemblies, the penetrations shall be protected in accordance with the requirements specified under "Through-Penetration Firestopping" in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

SUBMITTALS

Product data

A list of materials and equipment to be installed, manufacturer's descriptive data, and such other data as may be requested by the Engineer shall be submitted for approval.

Manufacturer's descriptive data shall include complete description, performance data and installation instructions for the materials and equipment specified herein. Control and wiring diagrams, rough-in dimensions for recessed junction and pull boxes, and component layout shall be included where applicable. All control and power conductors on the shop drawings shall be identified with wire numbers.

PART 2.- PRODUCTS

CONDUITS AND FITTINGS

Rigid steel conduit and fittings

Rigid steel conduit shall be threaded, full weight rigid steel, hot-dip galvanized inside and outside with steel or malleable iron fittings. Fittings shall be threaded unless otherwise specified or shown on the plans.

Split or three-piece couplings shall be electroplated, malleable cast iron couplings.

Insulated grounding bushings shall be threaded malleable cast iron body with plastic insulated throat and steel, lay-in ground lug with compression screw.

Insulated metallic bushings shall be threaded malleable cast iron body with plastic insulated throat.

Electrical metallic tubing (EMT) and fittings

Electrical metallic tubing shall be formed of cold rolled strip steel, electrical resistance welded continuously along the longitudinal seam with zinc coating outside and enamel or lacquer coating inside.

Couplings shall be electroplated, rain and concrete tight, gland compression type, steel body couplings with malleable iron nuts.

Connectors shall be electroplated, rain and concrete tight, gland compression type, steel body connectors with male hub, malleable iron nut and insulated plastic throat.

Flexible metallic conduit and fittings

Flexible metallic conduit shall be fabricated in continuous lengths from galvanized steel strip, spirally wound and formed to provide an interlocking design.

Fittings shall be electroplated screw-in type with malleable cast iron body and threaded male hub with insulated throat.

Liquid tight flexible metallic conduit and fittings

Liquid tight flexible metallic conduit shall be fabricated in continuous length from galvanized sheet steel, spirally wound and formed to provide an interlocking design with an extruded polyvinyl chloride cover.

Fittings shall be electroplated, malleable cast iron body, with cap nut, grounding ferrule, and connector body with insulated throat.

Rigid non-metallic conduit and fittings

Rigid non-metallic conduit shall be Schedule 40, high impact, nonconducting, self-extinguishing polyvinyl chloride (PVC) rigid non-metallic conduit for direct underground burial.

Couplings shall be PVC, socket type or thread on one end and socket type on the other end as required for the particular application.

Terminal adapters for adapting PVC conduit to boxes, threaded fittings, or metallic conduit system shall be PVC adapters with threads on one end and socket type on the other end.

CONDUCTORS

Conductors

Conductors shall be stranded copper wire.

Conductor insulation types unless otherwise shown or specified, shall be as follows:

1. Conductors across hinges of control panel enclosures shall be Type MTW.
2. Conductors shall be type XHHW-2 in wet and outdoor locations.
3. Conductors shall be type THHN in dry locations.

Wire connections and devices

Wire connections and devices shall be pressure or compression type, except that connectors for No. 10 AWG and smaller conductors in dry locations may be preinsulated spring-pressure type.

ELECTRICAL BOXES

Outlet, device and junction boxes

Unless otherwise shown or specified, boxes shall be galvanized steel boxes with knock-outs and shall be the size and configuration best suited to the application indicated on the plans. Minimum size of outlet, receptacle, switch or junction boxes shall be 100 mm square by 40 mm deep, except that switch boxes for the installation of single switches and outlet boxes for flush-mounted light fixtures shall be 50 mm by 75 mm by 40 mm deep.

Multiple switches shall be installed in standard gang boxes, unless otherwise specified or shown on the plans.

Cast metal boxes shall be cast iron boxes with threaded hubs and shall be of the size and configuration best suited to the application shown on the plans.

Flush-mounted boxes shall have stainless steel covers, one mm thick. Cover screws shall be metal with finish to match cover finish.

Unless otherwise shown or specified, surface-mounted boxes shall have galvanized steel covers with metal screws.

Weatherproof junction boxes shall have cast metal covers with gaskets.

Weatherproof switch and receptacle boxes shall have gasketed covers with gasketed hinged flaps to cover switches and receptacles.

Sectional device plates will not be permitted.

Underground pull boxes

Pull boxes shall be high density reinforced concrete box with ultraviolet inhibitor polyethylene etched face anchored in concrete and fiberglass cover with hold down bolts. The polyethylene and fiberglass material shall be fire resistant and show no appreciable change in physical properties with exposure to the weather. No. 5 pull box shall be Brooks Products No. 5; Christy Concrete Products, N30; or equal.

RECEPTACLES AND SWITCHES

Ground fault circuit interrupter receptacles, (GFCI

Ground fault circuit interrupter receptacles shall be NEMA Type 5-20R, feed-through type, ivory color, 3-wire, 20-ampere, 125-volt AC, grounding type, specification grade, duplex receptacle with ground fault interruption. Receptacle shall detect and trip at current leakage of 5 milliamperes and shall have front mounted test and reset buttons.

Duplex receptacles

Duplex receptacles shall be NEMA Type 5-20R, 3-wire, 20-ampere, 125-volt AC, safety grounding, ivory color, specification grade receptacle suitable for wiring with stranded conductors.

Management information services (MIS) receptacles

Management information services (MIS) receptacles shall be NEMA type 5-20, 3-wire, 20-ampere, 125-volt AC, isolated, grounding type, orange color, specification grade duplex receptacle suitable for wiring with stranded conductors.

Welding receptacles

Welding receptacles shall be surface-mounted, 600-volt, 60-ampere, 2-wire, 3-pole, circuit breaking, weather resistant, raintight receptacle with female interior assembly. The receptacle shall be complete with back box, angle adapter and spring door. The receptacle shall be grounded through extra pole and shell, and shall have crimp or solder type connections. A mating plug for the receptacle shall be provided.

Mobile vehicle lift receptacle

Mobile vehicle lift receptacle shall be surface mounted, 600 volt, 60-ampere, 3-wire, 4-pole circuit breaking, weather resistant, raintight, receptacle with female interior assembly. The receptacle shall be complete with back box, angle adapter and spring door. The receptacle shall be grounded through extra pole and shell, and shall have crimp or solder type connections. A mating plug for the receptacle shall be provided and connected to the mobile vehicle lift power cable.

Snap switches

Snap switches shall be 20-ampere, 120/277-volt AC, quiet type, specification grade, ivory color switch with silver cadmium alloy contacts. Switch shall be suitable for wiring with stranded conductors.

Motion sensor wall switches

Motion sensor wall switches shall be wall-mounted, 3-wire, 1500-watt incandescent or fluorescent, off-auto-on, passive infrared sensor switch with adjustable photocell override and time delay and shall operate on 120/277 volts. The sensor switch shall cover a minimum of 84 square meters of floor area, be suitable for installation in a single gang box, and shall have a field of view of not less than 170 degrees. The time delay setting shall be adjustable from 30 seconds to 20 minutes, initially set at 5 minutes. Light level adjustment shall be adjustable from 215 lux to 2153 lux, initially set at 753 lux.

Three-way toggle switches

Three-way toggle switches shall be 20-ampere, 120/277-volt AC, quiet type, specification grade, ivory color switch with silver cadmium alloy contacts. Switch shall be suitable for wiring with stranded conductors.

Combination heat fan light switch

Combination heat fan light switch shall be triplex-three rocker switches in a single gang box. Rocker switch shall be rated 15-ampere, 120-volt, AC switch.

Lights timer switch

Lights timer switches shall be a spring-wound mechanical timer switch with 2-hour range in a surface mounted weatherproof enclosure. The contact shall be rated 20-ampere at 125-volt AC.

Bypass timer switch

Bypass timer switches shall be a spring-wound mechanical timer switch with 2-hour range. The contact shall be rated 20-ampere at 125-volt AC.

MISCELLANEOUS MATERIALS

Warning Tape

Warning tape shall be 100 mm wide and contain the printed warning "CAUTION ELECTRICAL CONDUIT" in bold 19 mm black letters at 760 mm intervals on bright orange or yellow background. The printed warning shall be non-erasable when submerged under water and resistant to insects, acids, alkali, and other corrosive elements in the soil. The tape shall have a tensile strength of not less than 70 kg per 100 mm wide strip and shall have a minimum elongation of 700 percent before breaking.

Pull ropes

Pull ropes shall be nylon or polypropylene with a minimum tensile strength of 225 kg.

Watertight conduit plugs

Watertight conduit plugs shall be a hollow or solid stem expansion plugs complete with inner and outer white polypropylene compression plates and red thermoplastic rubber seal. Seal material shall be non-stick type rubber resistant to oils, salt, and alkaline substances normally available at the construction sites.

Anchorage devices

Anchorage devices shall be corrosion resistant, toggle bolts, wood screws, bolts, machine screws, studs, expansion shields, and expansion anchors and inserts.

Electrical supporting devices

Electrical supporting devices shall be one hole conduit clamps with clamp backs, hot-dipped galvanized, malleable cast iron.

Construction channel shall be 41 mm x 41 mm, 2.66 mm (12-gage) galvanized steel channel with 13 mm diameter bolt holes, 40 mm on center in the base of the channel.

Ground rod(s)

Ground rod(s) shall be a 19 mm (minimum) galvanized or copper clad steel rod, 3 meters long.

Telephone and speaker outlet boxes

Telephone outlet boxes shall be 102 mm square boxes and plates with modular type telephone outlet. Boxes on stud walls shall have plaster ring. Voice and data outlet jacks are combination of data and telephone jacks. Data jacks shall be 8-wire, RJ45 unkeyed data jacks with category 5 compliant, TIA/EIA 568 A, standard pin out. Telephone jacks shall be 4-wire, RJ11 jacks. Speaker outlets shall be similar except with blank plates.

Plates for flush mounting outlets in finished room shall be Type 430 stainless steel, one mm thick with satin finish.

PART 3.- EXECUTION

INSTALLATION

Conduit, general

Rigid steel conduit shall be used unless otherwise shown on the plans or specified in these special provisions.

Electrical metallic tubing may be used in furred spaces and for exposed work indoors above the switch height.

Unless otherwise specified or shown on the plans, flexible metal conduit shall be used to connect suspended lighting fixtures, motors, HVAC equipment, and other equipment subject to vibration in dry locations.

Unless otherwise specified or shown on the plans, liquid-tight flexible metal conduit shall be used to connect motors, HVAC equipment, and other equipment subject to vibration in wet locations.

Rigid non-metallic conduit shall be used at the locations shown on the plans for direct underground burial outside the building foundation.

Conduit installation

Conduit trade sizes are shown on the plans. No deviation from the conduit size shown on the plans will be permitted without written permission from the Engineer.

Conduit shall be concealed unless otherwise shown on the plans.

Conduits shall be tightly covered and well protected during construction using metallic bushings and bushing "pennies" to seal open ends.

Rigid non-metallic conduit bends of 30 degrees or greater shall be factory-made long radius sweeps. Bends less than 30 degrees shall be made using an approved heat box.

A pull rope shall be installed in all empty conduits. At least one meter of pull rope shall be doubled back into the conduit at each termination.

Locations of conduit runs shall be planned in advance of the installation and coordinated with the ductwork, plumbing, ceiling and wall construction in the same areas and shall not unnecessarily cross other conduits or pipe, nor prevent removal of ceiling tiles or panels, nor block access to mechanical or electrical equipment.

Where practical, conduits shall be installed in groups in parallel, vertical or horizontal runs and at elevations that avoid unnecessary offsets.

Exposed conduit shall be installed parallel and at right angles to the building lines.

Conduits shall not be placed closer than 300 mm from a parallel hot water or steam pipe or 75 mm from such lines crossing perpendicular to the runs.

All raceway systems shall be secured to the building structures using specified fasteners, clamps and hangers.

Single conduit runs shall be supported by using one hole pipe clamps. Where run horizontally on walls in damp or wet locations, conduit shall be installed with "clamp backs" to space conduit off the surface.

Multiple conduit runs shall be supported with construction channel secured to the building structure. Conduits shall be fastened to construction channel with channel compatible pipe clamps.

Raceways of different types shall be joined using approved couplings or transition fittings.

Expansion couplings shall be installed where conduit crosses a building separation or expansion joint.

All floor and wall penetrations shall be sealed water-tight.

Existing underground conduit to be incorporated into a new system shall be cleaned with a mandrel or cylindrical wire brush and blown out with compressed air.

Conduit terminations

Rigid steel conduits shall be securely fastened to cabinets, boxes and gutters using 2 locknuts and specified insulating metallic bushing. Electrical metallic tubing shall be securely fastened to cabinets, boxes and gutters using specified connectors. Conduit terminations at exposed weatherproof enclosures and cast outlet boxes shall be made watertight using specified hubs. All conduits terminations at wall mounted panels without knockouts shall be made in the front half of the panel.

Grounding bushings with bonding jumpers shall be installed on all type of conduits terminating at concentric knockouts and on all conduits containing service conductors, grounding electrode conductor, and conductors feeding separate buildings.

Rigid non-metallic conduits shall be securely fastened to the non-metallic boxes and lighting fixtures using specified connectors.

Rigid non-metallic conduits shall be terminated inside the underground pull boxes with an approved conduit bushings or fittings. All conduits shall enter the pull box at an angle of 45 degrees or more.

All future conduits terminated in underground pull boxes or exposed indoor and outdoor shall be provided with watertight conduit plugs.

Warning Tape

Warning tape shall be placed over each conduit in a trench. Each warning tape shall be centered over the conduit and shall be placed over the 150 mm layer of sand covering the conduit as described elsewhere in these special provisions.

Conductor and cable installation

Conductors shall not be installed in conduit until all work of any nature that may cause injury is completed. Care shall be taken in pulling conductors that insulation is not damaged. An approved non-petroleum base and insulating type pulling compound shall be used as needed.

All cables shall be installed and tested in accordance with manufacturer's recommendations.

Splices and joints shall be insulated with insulation equivalent to that of the conductor.

Provide 155 mm of slack at each outlet and device connection. If the outlet or device is not at the end of a run of wire, connection shall be made with correctly colored pigtails tapped to the runs with splices as specified herein.

Branch circuit conductors in panelboards and load centers shall be neatly trained along a path from the breaker terminals to their exit point. The conductors shall have ample length to transverse the path without strain, but shall not be so long as to require coiling, doubling back, or cramming. The path shall transverse the panelboard gutter spaces without entering a gutter containing service conductors and, unless otherwise shown on the plans, without entering the gutter space of any panelboard feeder.

All pressure type connectors and lugs shall be retightened after the initial set.

Splices in underground pull boxes and similar locations shall be made watertight.

Junction boxes in furred or accessible ceiling spaces shall be identified with felt-tip pen denoting the circuits contained in the box.

Conductor identification

The neutral and equipment grounding conductors shall be identified as follows:

Neutral conductor shall have a white or natural gray insulation except that conductors No. 4 and larger may be identified by distinctive white marker such as paint or white tape at each termination.

Equipment grounding conductor shall be bare or insulated. If insulated, equipment grounding conductors shall have green or green with one or more yellow stripes insulation over its entire length except that conductors No. 4 and larger may be permanently identified by distinctive green markers such as paint or green tape over its entire exposed insulation.

Ungrounded feeder and branch circuit conductors shall be color coded by continuously colored insulation, except conductors No. 6 AWG or larger may be color coded by colored tape at each connection and where accessible. Ungrounded conductor color coding shall be as follows:

SYSTEM	COLOR CODE
120/240V-Single phase	Black, blue
120/240V-Three phase	Black, orange, blue

Once an insulated circuit conductor, including grounded and ungrounded conductors, is identified with a specific color code, that color code shall be used for the entire length of the circuit.

Where more than one branch circuit enters or leaves a conduit, panel, gutter, or junction box, each conductor shall be identified by its panelboard and circuit number. All control conductors including control conductors of manufacturer supplied and field wired control devices shall be identified at each termination with the wire numbers shown on the plans, approved working drawings, and as directed by the Engineer where deemed necessary. Identification shall be made with one of the following:

1. Adhesive backed paper or cloth wrap-around markers with clear, heat shrinkable tubing sealed over either type of marker.
2. Self-laminating wrap around type, printable, transparent, permanent heat bonding type thermoplastic film markers.
3. Pre-printed, white, heat-shrinkable tubing.

Each terminal block shall have a molded marking strip attached with screws. The identifying numbers of the terminating conductors, as shown on the plans or on the submittal drawings, shall be engraved in the marking strip.

Outlet, device and junction box installation

Where exposed threaded steel conduits are connected to an outlet, device, or junction box below switch height, the box shall be a cast metal box. Unless otherwise shown on the plans or specified in these special provisions, all other boxes shall be sheet steel boxes. Weatherproof outlet, device and junction boxes shall have cast metal covers with gaskets. Unless otherwise shown on the plans or specified in these special provisions, all other boxes shall have standard galvanized covers.

All boxes shall finish flush with building walls, ceiling and floors except where exposed work is called for.

Raised device covers (plaster rings) shall be installed on all boxes concealed in concrete, masonry or stud walls.

No unused openings shall be left in any box. Knockout seals shall be installed as required to close openings.

Outlet, device, and junction boxes shall be installed at the locations and elevations shown on the plans or specified herein. Adjustments to locations may be made as required by structural conditions and to suit coordination requirements of other trades.

Boxes in stud walls and partitions shall not be mounted back to back. Through-wall boxes shall not be used.

Boxes installed in metal stud walls shall be equipped with brackets designed for attaching directly to the studs or shall be mounted on heavy gauge galvanized steel, snap-in box supports.

Fixture outlet boxes installed in suspended ceilings of gypsum board or lath and plaster construction shall be mounted on 1.52 mm (16-gage) metal channel bars attached to main ceiling runners.

Fixture outlet boxes for pendant-mounted fixtures installed in suspended ceilings supporting acoustical tiles or panels shall be supported directly from the structures above.

Underground pull box installation

Electrical pull box covers or lids shall be marked "ELECTRICAL." Telephone service pull box covers or lids shall have plain, unmarked covers.

The bottom of pull boxes shall be bedded in 155 mm of clean, crushed rock or gravel and shall be grouted with 40 mm thick grout prior to installation of conductors. Grout shall be sloped to a 25 mm PVC pipe drain hole. Conduit shall be sealed in place with grout.

Top of pull boxes shall be flush with surrounding grade or top of curb. In unpaved areas where pull box is not immediately adjacent to and protected by a concrete foundation, pole or other protective construction, the top of pull box shall be set at plus 30 mm above surrounding grade. Pull boxes shown on the plans in the vicinity of curbs shall be placed adjacent to the back of curb. Pull boxes shown on the plans adjacent to lighting standards shall be placed on the side of foundation facing away from traffic.

Ground rod(s) installation

The ground rod(s) shall be driven vertically until the top is 155 mm above the surrounding surface. When vertical penetration of the ground rod cannot be obtained, an equivalent horizontal grounding system, approved by the Engineer, shall be installed.

Anchorages

Hangers, brackets, conduit straps, supports, and electrical equipment shall be rigidly and securely fastened to surfaces by means of toggle bolts on hollow masonry; expansion shields and machine screws, or expansion anchors and studs or standard preset inserts on concrete or solid masonry; machine screws or bolts on metal surfaces; and wood or lag screws on wood construction.

Anchorage devices shall be installed in accordance with the anchorage manufacturer's recommendations.

Mounting heights

Electrical system components shall be mounted at the following mounting heights, unless otherwise shown on the plans. The mounting height dimensions shall be measured above the finished floor to the bottom of the device or component.

Thermostats	1.1 m, office areas 1.25 m, hallways
Wall switches	1.0 m
Convenience outlets	510 mm, office areas 1.25 m, all other areas
Electric water cooler outlet	As recommended by the water cooler manufacturer.
Telephone and radio outlets	510 mm

12-16.03 SERVICE AND DISTRIBUTION

PART 1.- GENERAL

SUMMARY

Scope

This work shall consist of furnishing and installing service and distribution equipment in accordance with the requirements of the serving utilities, the details shown on the plans and these special provisions.

Attention is directed to "Utility Connection" in Section 12-1, "General Requirements," of these special provisions regarding arrangements, permits, licenses, charges, fees and costs for utility connections and extensions.

Related work

Concrete and reinforcement for service pedestal shall conform to the requirements specified for minor work under "Cast-in-Place Concrete," in Section 12-3, "Concrete and Reinforcement," of these special provisions.

SUBMITTALS

Installation details

The Contractor shall submit complete service installation details to the serving utilities for approval. Prior to submitting installation details to the serving utility, the Contractor shall have said drawings reviewed and stamped "APPROVED" by the Engineer. Submittals shall be approved by the serving utility prior to commencing work.

Product data

A list of materials and equipment to be installed, manufacturer's descriptive data, and such other data as may be requested by the Engineer shall be submitted for approval.

Manufacturer's descriptive data shall include complete description, performance data and installation instructions for the materials and equipment specified herein. Control and wiring diagrams, rough-in dimensions, and component layout shall be included where applicable. All control and power conductors on the shop drawings shall be identified with wire numbers.

Manufacturer's descriptive data shall be submitted for the following:

Main switchboard (MSB)

PART 2.- PRODUCTS

Main Switchboard, MSB

Main switchboard, MSB, shall contain a pull section, metering compartment and service disconnect switch section, empty section for future automatic transfer switch, and distribution section for 240/120-volt, 600-ampere, 3-phase, 4-wire service.

Distribution section shall contain a distribution panel with feeder disconnects with trip rating as shown on the plans. Feeder disconnects shall be molded case circuit breakers with minimum interrupting capacity of 42000 amperes (symmetrical) at 240 volts.

Enclosure

Enclosure shall be NEMA 3R enclosure. Exterior shall be 2.66 mm (12-gage) and interior shall be 1.90 mm (14-gage) sheet steel. All screws, latches, hinge pins and similar hardware shall be stainless steel. Circuit breaker shall be operable with the exterior door open. Exterior door shall be lockable with a padlock. Enclosure finish shall be baked enamel or baked thermosetting polyester finish.

Service disconnect switch

Service disconnect switch shall be 3-pole, 240-volt, 600-ampere frame, 600-ampere trip, molded case circuit breaker with AC magnetic trip adjusted to 3,000 amperes. The interrupting capacity of the circuit breaker shall be 42,000 amperes (symmetrical) at 240 volts. Breaker shall be Westinghouse, Square D, General Electric, or equal.

Lightning arrester and surge capacitor

Lightning arrester and surge capacitor shall be suitable for use at the service entrance of a 120/240 volt, three-phase, 4-wire, 60 Hz distribution system and shall be mounted inside the service disconnect switch compartment. Lightning arrester shall meet the design tests as required by ANSI/IEEE C62.1 for 10 kA, 8x10 microsec impulses. Lightning arrester and surge capacitor shall be as manufactured by General Electric; Delta; or equal.

Concrete

Concrete for service pedestal shall be commercial quality concrete, proportioned to provide a workable mix for the intended use; shall contain not less than 285 kilograms of cement per cubic meter.

PART 3.- EXECUTION

Foundation for main switchboard shall be as shown on the plans.

Installation of main switchboard equipment shall be in accordance with the requirements of the serving utilities as shown on the approved installation details.

12-16.04 ELECTRICAL EQUIPMENT

PART 1.- GENERAL

SUMMARY

Scope

This work shall consist of furnishing and installing panelboards, starters, disconnect switches, transformers, and related accessories in accordance with the details shown on the plans and these special provisions.

Related work

Anchorage devices shall be as specified under "Basic Materials and Methods" elsewhere in this Section 12-16.

SUBMITTALS

Product data

A list of materials and equipment to be installed, manufacturer's descriptive data, and such other data as may be requested by the Engineer shall be submitted for approval.

Manufacturer's descriptive data shall include complete description, performance data and installation instructions for the materials and equipment specified herein. Control and wiring diagrams, rough-in dimensions, and component layout shall be included where applicable. All control and power conductors on the shop drawings shall be identified with wire numbers.

PART 2.- PRODUCTS

PANELBOARDS

Panelboard E

Panelboard E shall be indoor type, bottom-feed surface-mounted, factory assembled, single-phase, 3-wire, 240/120-volt, AC panelboard at least 500 mm wide with 200-ampere main circuit-breaker, insulated groundable neutral, hinged door and molded case branch circuit breakers as shown on the plans. Panel shall be Square D Company, Westinghouse, General Electric, or equal.

Panelboard AA

Panelboard AA shall be indoor type, bottom-feed surface-mounted, factory assembled, 3-phase, 4-wire, 240/120-volt, AC panelboard at least 500 mm wide with 200-ampere main circuit-breaker, insulated groundable neutral, hinged door and molded case branch circuit breakers as shown on the plans. Panel shall be Square D Company, Westinghouse, General Electric, or equal.

Panelboard BB

Panelboard BB shall be indoor type, bottom-feed surface-mounted, factory assembled, single-phase, 3-wire, 240/120-volt, AC panelboard at least 500 mm wide with 100-ampere main circuit-breaker, insulated groundable neutral, hinged door and molded case branch circuit breakers as shown on the plans. Panel shall be Square D Company, Westinghouse, General Electric, or equal.

Panelboard CC

Panelboard CC shall be indoor type, bottom-feed surface-mounted, factory assembled, 3-phase, 4-wire, 240/120-volt, AC panelboard at least 500 mm wide with 150-ampere main circuit-breaker, insulated groundable neutral, hinged door and molded case branch circuit breakers as shown on the plans. Panel shall be Square D Company, Westinghouse, General Electric, or equal.

Panelboard DD

Panelboard DD shall be indoor type, bottom-feed surface-mounted, factory assembled, single-phase, 3-wire, 240/120-volt, AC panelboard at least 500 mm wide with 200-ampere main circuit-breaker, insulated groundable neutral, hinged door and molded case branch circuit breakers as shown on the plans. Panel shall be Square D Company, Westinghouse, General Electric, or equal.

Panelboard T

Panelboard T shall be outdoor type, bottom-feed surface-mounted, factory assembled, single-phase, 3-wire, 240/120-volt, AC panelboard at least 500 mm wide with 150-ampere main circuit-breaker, insulated groundable neutral, hinged door and molded case branch circuit breakers as shown on the plans. Panel shall be Square D Company, Westinghouse, General Electric, or equal.

Panelboard W

Panelboard W shall be indoor type, bottom-feed surface-mounted, factory assembled, 3-phase, 4-wire, 240/120-volt, AC panelboard at least 500 mm wide with 100-ampere main circuit-breaker, insulated groundable neutral, hinged door and molded case branch circuit breakers as shown on the plans. Panel shall be Square D Company, Westinghouse, General Electric, or equal.

STARTERS--

Air compressor starter

Air compressor starter shall be combination 3-pole, 240-volt, NEMA Size 1, NEMA rated, line voltage starter and motor circuit protector in a NEMA-1 enclosure. Air compressor starter shall have two, 2-ampere, dual element, 250-volt fuses with 2-pole barrier type fuse base; 240-volt coil, double-break silver contacts and 3 manual reset, non-adjustable thermal overloads, set to trip between 115 and 125 percent of full load motor current, as quoted on the nameplate by the motor manufacturer. Reset button shall be externally operable.

Evaporative cooler starter

Evaporative cooler starter shall be combination 3-pole, 240-volt, NEMA Size 0, NEMA rated, line voltage starter and motor circuit protector in a NEMA-1 enclosure. Evaporative cooler starter shall have dual element fuse sized to suit circulating pump, 120-volt coil, double-break silver contacts and a 3-pole manual reset, non-adjustable thermal overloads, set to trip 115 and 125 percent of full load motor current, as quoted on the nameplate by the motor manufacturer. Reset button shall be externally operable from the enclosure.

Declassification fan control panels

Each declassification fan control panel shall be single exterior hinged door NEMA Type 12 enclosure containing a fixed interior electrical mounting panel.

The enclosure shall be factory prewired in conformance with NEMA Class IIC wiring. All wires entering or leaving the enclosure shall terminate on terminal blocks. Control wiring shall be 7 stand no. 14 MTW except for hung wiring, which shall be 19 strand No. 14 MTW. Wiring shall be neatly trained and bundled, and wiring troughs shall be provided in the enclosure as necessary. Wiring shall be arranged so that any piece of apparatus may be removed without disconnecting any wiring except the leads to that piece of apparatus.

A wiring diagram encased between 2 heat-fused laminated plastic sheets shall be provided with brass mounting eyelets and attached to the inside of the enclosure.

The following equipment shall be mounted on the interior mounting panel:

Circuit breaker
Motor disconnects
Starters
Control disconnect

The following equipment shall be mounted on the exterior door of the cabinet:

Operating handle of CB
Start-stop pushbuttons, and pilot light.

Circuit breakers, CB

Circuit breakers, CB, shall be 3-pole, 20-ampere for repair bay and 30-ampere for equipment bays, and 240-volt rated panel mounted circuit breaker.

Starters, ST1, ST2, ST3

Starters shall be NEMA rated, 3-pole 240-volt, 120-volt coil, and non adjustable overload relay. Overload relay shall be re-settable by and externally operable pushbutton on the exterior door. Overload relay shall have 3 thermal overload elements and shall trip between 115 and 125 percent of full load current, as quoted on the name plate by the motor manufacturer.

Motor disconnects, MD1, MD2, MD3

Motor disconnects switch shall be 3-pole, 15-ampere, panel 240-volt panel mounted circuit breaker.

Start-stop pushbuttons

Pushbuttons shall be 25 mm diameter oil-tight pushbuttons. Contact block shall be rated 10 amperes at 120 volts. Start pushbutton shall have a green operator and stop pushbutton shall have a red operator.

Pilot light, PL

Pilot light shall be panel mounting light with green lens with screw cap and a direct incandescent replacement LED, 120-volt lamp with candelabra screw base.

Control disconnect, CD

Control disconnect shall be single-pole, 15-ampere, 120-volt circuit breaker.

Remote Pushbutton station

Remote pushbutton station shall be 25 mm diameter oil-tight start-stop pushbuttons enclosed in surface mounted type NEMA 12 enclosure. Contact block shall be rated 10 amperes at 120 volts. Start pushbutton shall have a green operator and stop pushbutton shall have a red operator.

Circulating pumps control panel

Circulating pumps control panel enclosure shall be single exterior hinged door, dust tight NEMA Type 12 containing an electrical mounting panel and door clamps. The enclosure shall be factory prewired in conformance with NEMA Class II, Type C wiring. The following components shall be mounted on the door: Selector switches, SS1, and SS2. The following components shall be mounted on the electrical mounting panel: Main circuit breaker, CB; Pump disconnects, PD1, and PD2; Control disconnect, CD; Boiler Control Panel Disconnect, BCPD; Starters, ST1, and ST2; Relay, R1; and terminal blocks, TB. The main circuit breaker shall be externally operable. The door shall only open when the main circuit breaker, CB, is in the "OFF" position.

All circuit breakers except for CD and BPCD shall 240-volt with number of poles and trip rating as shown on the plans. CD and BCPD shall be 120-volt circuit breakers. All starters shall be 2-pole, 240-V, NEMA Size 0, NEMA rated, line voltage starter. Starter shall have 120-V coil, double-break silver contacts and manual reset, non-adjustable thermal overloads, set to trip between 115 and 125 percent of full load motor current, as quoted on the nameplate by the motor manufacturer. Selector switch shall be rotary action, single-pole, 3-position, 10-A, 120-V switch. Switch contacts shall have an inductive pilot duty rating of 60 A (make), 6 A (break) and 10 A (continuous) at 120 V and 35 percent power factor. Selector switch shall have legend plate marked MANUAL-OFF-AUTO. Relay shall be 120 V(ac) coil, general purpose relay with 2-pole, double-throw, 10 A, 120 V(ac) contacts. Relay shall be enclosed in a clear plastic with 8-pin plug base. Socket for the relay shall be barrier type, 8-contacts relay socket with 10 A contacts and screw terminals.

All the components mounted inside the enclosure shall be identified with nameplates having the abbreviation used on the plans (CB, PD1, PD2, CD, BCPD, ST1, ST2, R1). The panel, the operating handles of the circuit breakers and the selector switches shall have identification nameplate with inscription identifying their functions (CIRCULATING PUMPS CONTROL PANEL, BOILER, PUMP 1, PUMP 2, and CONTROL). All letters shall have 7 mm height. All nameplates mounted on the door shall be attached to the door using glue.

SWITCHES

Crane disconnect

Crane disconnect shall be 3-pole, 240-volt, 100-ampere frame, enclose molded case circuit breaker in NEMA-1 enclosure. The trip rating of the circuit breaker shall be selected to suit the crane motors furnished. The interrupting capacity of the circuit breaker shall be 10,000 amperes (symmetrical) at 240-volt.

Condensing unit disconnect switches

Condensing unit disconnect switches shall be 2-pole, 240-volt, AC, fusible, heavy duty safety switch in a NEMA -3R enclosure with provision for padlocking in the "OFF" position. The ampere rating and fuses shall be sized to suit the condenser unit of the air conditioning units furnished.

Storage building disconnect switch

Storage building disconnect switch shall be 3-pole, 240-volt, 200-ampere frame, 200-ampere trip, molded case circuit breaker in a NEMA -3R enclosure. The interrupting capacity of the circuit breaker shall be 10,000 amperes (symmetrical) at 240 volts.

Evaporative cooler disconnect switch

Evaporative cooler disconnect switch shall be 3-pole, 240-volt, AC, 30-ampere, non-fusible, general duty safety switch in a NEMA-3R enclosure with provision for padlocking in the "OFF" position.

Evaporator cooler selector switch

Evaporator cooler selector switch shall be installed in a surface-mounted enclosure near the evaporator cooler starter. Selector switch shall have a legend plate marked "OFF-PUMP-COOL-VENT".

Door operator disconnect switch

Door operator disconnect switch shall be 3-pole, 240-volt, AC, 30-ampere, non-fusible, general duty safety switch in a NEMA-1 enclosure with provision for padlocking in the "OFF" position.

Fume exhaust fan manual motor starting switch

Fume exhaust fan manual motor starting switch shall be 3-pole, 240-volt, manual starter in a NEMA Type 1 enclosure complete with thermal overloads.

EEHR disconnect switch

EEHR disconnect switch in the repair bay shall be single-pole, 120-volt, fractional horsepower motor manual starter with toggle type operator in a NEMA Type 1 enclosure complete with thermal overload.

MISCELLANEOUS MATERIALS

Nameplates

Nameplates shall be laminated phenolic plastic with white core and black front and back. Nameplate inscription shall be in capitals letters etched through the outer layer of the nameplate material.

Warning plates

Warning plates shall be laminated phenolic plastic with white core and red front and back. Warning plates inscription shall be in capitals letters etched through the outer layer of the nameplate material.

Plywood backing board

Plywood backing board for mounting electrical, radio, or telephone equipment shall be 19 mm, APA plywood panels, C-D PLUGGED and touch-sanded, Exposure 1.

PART 3.- EXECUTION

INSTALLATION

Plywood backing board

Plywood backing board shall be securely fastened to walls or other vertical framing.

Surface to be coated shall be cleaned of all dirt, excess materials, of filler by hand cleaning.

Plywood backing board exposed surfaces shall receive the following paint system: one prime coat, alkyd, interior wood primer and 2 finish coats, acrylic, interior enamel, semi-gloss. Color shall match surrounding surfaces, or shall be as directed by the Engineer.

Coatings shall be applied in accordance with the manufacturer's instructions. Each coat shall be applied to a uniform finish, free of skips, brush marks, laps or other imperfections.

Existing panelboards--

Provide new circuit breakers, where required to match existing type unless otherwise shown on the plans. Provide mounting hardware, bus straps, and related materials for proper circuit breaker installation. Provide new panelboard identification nameplate with designation as shown for each panelboard. Remove existing nameplates where applicable. Provide new typewritten circuit directory reflecting changes made under the Contract.

Panelboard installation

Set cabinets plumb and symmetrical with building lines. Train interior wiring as specified under "Conductor and Cable Installation" in "Basic Materials and Methods" of these special provisions. Touch-up paint any marks, blemishes, or other finish damage suffered during installation. Replace cabinets, doors or trim exhibiting dents, bends, warps or poor fit which may impede ready access, security or integrity.

Mounting height shall be 1.67 meters to the highest circuit breaker handle, measured above the finished floor.

Where "Future" or "Space" is indicated on the plans, branch connectors, mounting brackets, and other hardware shall be furnished and installed for future breaker.

A typewritten directory under transparent protective cover shall be provided and set in metal frame inside each cabinet door. Directory panel designation for each circuit breaker shall include complete information concerning equipment controlled, including room number or area designated on the plans.

Equipment identification

Equipment shall be identified with nameplates fastened with self-tapping, cadmium-plated screws or nickel-plated bolts.

Unless otherwise shown on the plans, nameplate inscriptions shall be 7 mm high letters and shall be as shown on the plans and as follows:

1. Inscriptions for panelboards shall include panel designation, voltage, and phase of supply and shall read in the following example: PANEL E, 120/240-VOLTS, 1-PHASE.
2. Inscription for disconnect switches, starter, timer, fan and pushbuttons shall be the respective device it is controlling and shall read in the following example: OVERHEAD DOOR.
3. Inscription for lighting control panel, intrusion alarm control panel and fire alarm panel shall be the panel designation as shown in the plans and shall read in the following example: OUTSIDE LIGHTS CONTROL STATION.

Warning plates

Warning plates shall be attached to designated equipment with self-tapping cadmium-plated screws or nickel-plated bolts.

Warning plate inscriptions shall read as shown on the plans.

Signs

Signs with the messages as shown on the plans shall be fastened to the wall with anchorage devices.

12-16.05 LIGHTING

GENERAL

This work shall consist of furnishing, installing and connecting all lighting equipment in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Manufacturer's descriptive information, photometric curves, catalog cuts, and installation instructions shall be submitted for approval. Wiring diagrams for lighting control station and lighting control panels shall be submitted for approval.

PRODUCTS

Lighting fixture lamps

Lighting fixture lamps shall be type and size as shown on the plans. Lamps shall be General Electric, Phillips, Sylvania, or equal. Fluorescent lamps, unless otherwise noted, shall be 4100K tri-phosphor with a CRI of 70 or greater.

Ballasts

All fixtures shall be equipped with high power factor ballasts suitable for the line voltage and for the type, size and number of lamps required by the fixture. Fluorescent ballasts shall be UL Listed, Class P and ETL Certified ballasts with sound rating A. Fluorescent ballasts shall be high-frequency electronic ballasts with power factor greater then 0.95, nominal ballast factor of 0.88 unless specified otherwise, total harmonic distortion less than 20 percent, crest factor less than or equal to 1.7, complying with ANSI C 62.41 Category A for surge protection, and FCC Part 18 for interference.

Lighting fixtures

Lighting fixtures shall be as shown on the plans and as specified herein. Outdoor luminaires shall be listed and labeled "Fixture Suitable For Wet Locations."

F1

Ceiling-mounted fluorescent fixture with four-32 watt T8 lamps, 120-volt, electronic ballast and one-piece, clear acrylic, wrap-around diffuser. The fixture shall be Day Brite, Lithonia, or equal.

F2

Ceiling-mounted fluorescent fixture with two-32 watt T8 lamps, 120-volt, electronic ballast and one-piece, clear acrylic, wrap-around diffuser. The fixture shall be Lithonia, Day Brite, or equal.

F3

Similar to F2 except F3 shall be U.L. listed for use in damp location.

F4

Recessed square housing compact fluorescent fixture with 26-watt, electronic ballast and flat fresnel lens. The fixture shall be Capri Lighting, Kirlin or equal.

F5

Stem-mounted general purpose industrial fluorescent fixture with two 60-watt high output lamps, 800 MA electronic ballast and baked enamel ribbed reflector complete with end plates. The fixture shall be Day-Brite, Lithonia, or equal.

F6

Similar to F5 except F6 shall be bracket mounted.

F7

Ceiling-mounted enclosed and gasketed industrial fluorescent fixture with two high output , 110-watt lamps, 120-volt, zero degree ballast and one-piece, clear acrylic diffuser. The fixture shall be suitable for damp location. The fixture shall be Day-Brite, Lithonia, or equal.

H1

Pole mounted, 250-watt, 240-volt, high pressure sodium, cutoff luminaire with integral ballast. The luminaire shall fit at the end of arm as shown on the plans. The luminaire shall be General Electric, Lithonia, or equal.

Pole for luminaire shall be round tapered galvanized steel, have 331 MPa minimum yield strength, with dimensions as shown on plans. The pole shall be able to withstand stresses produced by steady state wind with velocity of 129 km/hr. Pole shall have hand hole with cover plate, base plate and all necessary hardware.

MH1

Outdoor, wall mounted, 70-watt, 120-volt, metal halide luminaire with integral ballast. The fixture shall be Holophane Wallpack Series; Lithonia, TWH Series; or equal.

MH2

Similar to MH1 except MH2 shall be 150-watt.

MH3

Flood light luminaire, 175-watt, 120-volt, metal halide luminaire with integral ballast and yoke mount bracket. The fixture shall be Ruud, MFS4 Series; GE, Powerflood Series; or equal.

MH4

Similar to MH1 except MH4 shall be 125-watt and ceiling mounted.

I1

Wall mounted 75-watt, 120-volt incandescent lamp with porcelain socket mounted on round or octogonar junction box.

Fused splices

Fused splices shall be Buss, Elastimold, or equal; with standard midget, ferrule, 5-ampere, 240-volt, slow blowing fuses.

Photoelectric unit, PEC

Photoelectric unit shall be cadmium sulfide photoelectric control with capacity of 1800-watt inductive or fluorescent load, mounting adapter, and EEI-NEMA twist lock receptacle; Fisher-Pierce, Ripley, or equal.

Hallway and restroom lighting control station, LCS1, equipment bays lighting control station, LCS2 and truck and repair bays lighting control station, LCS3.

Lighting control stations LCS1, LCS2 and LCS3, shall consist of a lighting contactor, time clock, terminal block, selector switch and pilot light in a surface mounted NEMA-12 enclosure with a hinged door.

Lighting contactor, LC

Lighting contactor shall be electrically held, lighting contactor with 120-volt AC coil and 20-ampere, double-break, silver alloy contacts; Square D Company, I.T.E., General Electric, or equal. Number of poles for each contactor shall be as shown on the plans.

Time clock , TC

Time clock shall be a 120-volt, AC, solid-state programmable timer with power on-off and manual override. Time clock shall be able to program for a minimum of 3 independent schedules for any days of the week, in addition to being able to skip selected days. Time clock shall have a single-pole, double-throw output contact shall be rated at not less than 16-ampere, 120-volt, AC.

Selector switch, SS

Selector switch shall be rotary action, single-pole, 3-position, 10-ampere, 120-volt switch. Switch contacts shall have an inductive pilot duty rating of 60 amperes (make), 6 amperes (break) and 10 amperes (continuous) at 120 volts and 35 percent power factor. Selector switch shall have legend plate marked MANUAL-OFF-AUTO.

Pilot light, PL

Pilot light shall be panel mounted, heavy duty, oil tight indicating light with 120-volt, AC, LED lamp with green domed cap.

Terminal block, TB

Terminal block shall be 30-ampere, 300-volt, molded plastic with two or more mounting holes and two or more terminals in each cast block. The molded plastic shall have a high resistance to heat, moisture, mechanical shock, and electrical potential and shall have a smooth even finish. Each block shall have a molded marking strip attached with screws. Terminal blocks shall have tubular, high pressure clamp connectors.

Outside light control station, OLCS

Outside light control station shall be the same as lighting control station, LCS1, except the TC shall be omitted.

Concrete

Concrete shall be as specified under "Cast-In-Place Concrete" in Section 12-3, "Concrete and Reinforcement," of these special provisions. The concrete shall be commercial quality portland cement concrete containing not less than 337 kilograms of cement per cubic meter.

FABRICATION--

Component mounting

The following electrical components shall be mounted on the back panel of the outside light control station enclosure:

Terminal Block, TB
Lighting contactors, LC

The following electrical components shall be mounted on the hinged door of the outside light control station enclosure:

Selector switch, SS
Pilot light, PL

EXECUTION

LIGHTING FIXTURES

Lighting fixtures shall be mounted securely in accordance with the manufacturer's recommendations. Mounting methods shall be suitable for the particular type of ceiling or support at each location.

The Contractor shall provide all supports, hangers, spacers, channels, fasteners and other hardware necessary to support the fixtures.

Fixtures shall be set at the mounting heights shown on the plans, except heights shown shall be adjusted to meet conditions.

BALLASTS

All fluorescent fixtures shall be equipped with high power factor ballasts suitable for the line voltage and for the type, size and number of lamps required by fixture. The Contractor has the option to install low voltage dimming control provided that the Contractor submit plans and specifications with appropriate revisions for the low voltage dimming control to the Engineers for approval prior to installation.

All ballasts used in unheated areas inside the building shall be -20°C ballasts or less.

POLE MOUNTED LUMINAIRES

In the pull box adjacent to each pole for luminaire, H1, a fused splice connector shall be installed in each ungrounded conductor between the line and the ballast. The connector shall be readily accessible in the pull box and shall be insulated and made waterproof in accordance with the splice connector manufacturer's recommendations.

Concrete foundations shall be as shown on the plans. Anchor bolts or devices shall be accurately located and positioned to match the holes in the pole base plates. Pole and luminaire orientation shall be as indicated on the plans.

The poles for pole mounted type fixtures shall be mounted rigidly and securely on the foundations as recommended by the fixture and pole manufacturer.

12-16.06 FIRE ALARM AND DETECTION SYSTEM

PART 1.- GENERAL

SUMMARY

Scope

This work shall consist of furnishing and installing a complete and operational fire alarm and detection system in accordance with the details shown of the plans and these special provisions.

The system shall include all materials, whether mentioned or not, but are necessary for the complete and operational fire alarm and detection system.

SYSTEM DESCRIPTION

Design Requirements

The fire alarm and detection system shall be a low voltage, direct current, zoned, closed circuit, electrically supervised, and Class A fire alarm and detection system. The system shall consist of fire alarm control panel, manual pull stations, smoke detectors, duct smoke detectors, heat detectors, end-of-line resistors, audio-visual devices, and all other necessary appurtenances.

The alarm system components shall be listed by U.L. or F.M. and the California State Fire Marshal.

SUBMITTALS

Product data

Manufacturer's descriptive information and installation instructions shall be submitted for approval.

Installation instructions shall include brand name and catalog reference of equipment supplied, wiring diagrams, battery calculations, voltage drop calculations, riser diagrams and floor plans showing all devices and conduit and conductor sizes.

Working drawings

Complete working drawings shall be submitted for approval.

State Fire Marshal approval

In addition to the requirements specified under "Submittals" in Section 12-1, "General Requirements," of these special provisions, allow an additional 12 weeks for State Fire Marshal review and approval.

PART 2.- PRODUCTS

Fire alarm control panel

Fire alarm control panel shall be surface-mounted, locking cabinet, completely self-contained control panel suitable for 120-volt, AC, input power with separate terminals for all external wires and end-of-line resistors installed within the control panel.

The control panel shall conform to the following requirements:

Compatible with Radionics 6000 or 6500 receiver or equivalent;
Zones as shown on plans plus four spare zones;
Digital dialer communicator;
Audible trouble signal, silencing switch and trouble pilot light;
Solid state, modular construction;
Fan shut down relays;
24-hour standby batteries, battery charger with automatic transfer on loss of utility company power and retransfer upon restitution of utility power;
Indicating lights for normal power failure, battery power failure, audible alarm, and silencing switch;
Low battery reporting.

Manual pull station

Manual pull station shall be single-action, non-coded, closed circuit, pull down type pull station mounted on a standard electrical outlet box. The manual pull station actuating contact shall function continuously until reset. The pull station shall have provisions for fire drill and testing and shall have integral LED light to indicate operation of the pull station.

Smoke detector

Smoke detector shall be ionization type detector with dual chamber with sensitivity control and plug-in detector head. One chamber shall be for detection and the other for changes in ambient parameters. The smoke detector shall have integral LED light to indicate operation of the smoke detector.

Combination smoke and fire damper

Combination smoke and fire damper shall be approved or listed by the State Fire Marshal. Damper assembly shall be 1 1/2 hour or 3 hour fire rated (as required by the plans) under UL Standard 555 and shall be a Leakage Rated Damper for use in smoke control systems meeting the requirements of the latest version of UL 555S. Combination smoke and fire damper shall be equipped with a fusible link rated at 74°C, have a 115-volt shaded pole motor actuator and an approved smoke detector. Bearings shall be stainless steel sleeve turning in an extruded hole in the frame. Damper and actuator shall be supplied as a single entity which meets all applicable UL Standards. Damper shall have all galvanized steel parts. Damper shall be installed at the locations shown on the plans.

Duct-mounted smoke detector

Duct-mounted smoke detector shall be ionization type detector with dual chamber with sensitivity control and plug-in detector head, 115-volt. One chamber shall be for detection and the other for changes in ambient parameters. The smoke detector shall have integral LED light to indicate operation of the smoke detector. Duct-mounted smoke detector shall have a sampling tube, test jack, and shall have uniform sensitivity between 150 meters to 940 meters per minute air velocity. Duct-mounted smoke detector shall activate combination smoke and fire damper actuator upon smoke detection.

Heat detector

Heat detector for automatic detection of fire shall be of compact and rugged construction employing rate-of-rise and fixed temperature methods of detecting fires. The heat detectors shall have twist-and-lock type plug-in detector head, and low profile.

Audio-visual device

Audio-visual device shall be vibrating type horn with flashing light and adjustable volume control with maximum audible output of 90 dB at 3 meters from the horn. Frequency of audio visual flash shall be not less than one flash per second.

Fire bell

Fire bell shall have voltage rating as required and shall be listed by U. L. and the California State Fire Marshal.

PART 3.- EXECUTION

INSTALLATION

General

The fire alarm system shall be installed in accordance with the manufacturer's recommendations. No modification of the recommended alarm system type, components type, or replacement shall be made without prior written approval from the Engineer.

Conduit and conductors

Fire alarm system wiring shall be installed in conduits conforming to the requirements of "Basic Materials and Methods" elsewhere in these special provisions. Conduit size shall be as recommended by the fire alarm system manufacturers except that conduits shall be not less than 16 mm diameter, trade size. All conduits shall be concealed in ceiling or walls. All other conduits shall be exposed conduit.

Conductors and cables for the fire alarm system shall be as recommended by the fire alarm system manufacturer.

FIELD QUALITY CONTROL

Testing

The operational test for the fire alarm system shall be performed by the Contractor in the presence of the Engineer. The operational tests shall demonstrate that all functions of the system operate in the manner described in the manufacturer's literature and that the system is stable under normal vibration and shocks to components. The Contractor shall notify the Engineer in writing not less than 10 days in advance of performing the operational tests.

Monitoring

The contractor shall provide monitoring services for the facility for one year after the acceptance of the contract. The services shall include a toll-free telephone line connecting to the 24-hour on call monitoring station. Monitoring station shall contact designated site representative in the event of alarm and dispatch an immediate on-site response to the alarm location if the site representative cannot be reached or verification of the cause of the alarm cannot be determined.

Monitoring services after the first year will be handled by the State.

DEMONSTRATION

Training

The Contractor shall provide one hour of on-site training on the use, operation, and, maintenance of the system for not more than 8 designated State employees. The Contractor shall notify the Engineer in writing not less than 10 days in advance of proposed training class.

12-16.07 INTRUSION ALARM SYSTEM

PART 1.- GENERAL

SUMMARY

Scope

This work shall consist of furnishing and installing a complete and operational intrusion alarm system in accordance with the details shown on the plans and these special provisions at the Chester Maintenance Yard Facility.

The system shall include all materials, whether mentioned or not, that are necessary for a complete and operational intrusion alarm system.

SYSTEM DESCRIPTION

Design requirements

The intrusion alarm reporting system shall be a low voltage, direct current, zoned alarm system, and shall consist of a master reporting control panel in the mechanical room, magnetic contact switches, glass break discriminators, combination detectors, and digital keypad stations for designated control points into the building. Each zone shall be a "supervised, Class B circuit". The end of line resistor shall be installed in the identified control panel.

The alarm system shall self-test and report status of individual zones every twenty-four (24) hours.

The alarm system shall provide an automatically rechargeable back-up power supply system, 24-hour minimum, in case of building power interruption.

The intrusion alarm reporting system components shall be UL Listed for Commercial usage or F.M. Listed. The system proposed shall be approved by the Federal Communication Commission (FCC).

SUBMITTALS

Product data

Manufacturer's descriptive information and installation instructions shall be submitted for approval.
Installation instructions shall include manufacturer and catalog reference, and model number of equipment to be furnished, conduit and conductor sizes, wiring diagram, and floor plan showing locations of devices.

QUALITY ASSURANCE

Installer qualification

The installer of the security alarm system shall be licensed by the State Department of Consumer Affairs, Bureau of Collection and Investigative Services. License numbers and expiration dates shall be included on all correspondence.

PART 2.- PRODUCTS

Control panel

The master control panel (Radionics 9112B) shall be a surface mounted, locking cabinet, completely self-contained control panel suitable for 120-volt, AC, input power with separate terminals for all external wires.

The control panel shall meet the following requirements:

Control panel, shall be U.L. Listed for Commercial Fire and Burglar reporting;
Minimum eight (8) zones (capable of zone expansion);
Digital dialer communicator;
12-volt auxiliary power supply (minimum 24 hours);
Rechargeable battery (24 hour minimum);
Battery charger; Low battery reporting; Silent alarm signaling;
System connected to RJ31X or RJ38X telephone jack or equivalent;
Line test every twenty-four (24) hours;
120-volt, AC, input;
Front accessible control and indication digital keypad.
U.L. Listed for commercial use;
Remote Control identification.

Magnetic contact switch

Magnetic door switch for pedestrian door shall be a 2-section, self-lock mounting type switch, and shall be compatible with the material of the door on which it is installed. The switch shall be epoxied in the switch housing. Magnetic contact switches shall be the type capable of being concealed on the top of the door frame.

Magnetic contact switches for the overhead vehicle doors shall be a 2-section, extra heavy-duty, floor mounting type switch with stainless steel armored cable.

Switch shall be housed in a non-magnetic case.

Glass break discriminator

Glass break discriminator shall be an acoustic glass break detector with advanced technology for sensing and reporting simultaneous sound and shock wave activity. Detector shall respond to energy of breaking windows using piezo-electric crystal microphone. Sensor coverage pattern shall be directional, detecting breakage of uncovered glass in a 35-foot wide area at a distance of 12 feet. The sensor shall be housed in a fire retardant ABS housing.

Digital keypad

Keypad shall be weatherproof 12 button keypad with 16 user codes capable of expansion to 120, surface-mounted, low voltage (12VDC/24VDC), vandal resistant device with programmable ability for user codes 1-6 digits. Keypad will have an EEPROM memory for backup of all codes, have a relock time delay adjustable time from 1-90 seconds or on/off and have a tamper switch to detect unauthorized access to the keypad working mechanism. The keypad will have incorporated four(4) on-board relays for electric door locks, alarm shunting, forced door monitoring and door ajar monitoring.

Multiple switch contact monitor

The multiple switch contact monitor shall have six (6) contact points: four (4) monitored contacts, one (1) supervised tamper and one (1) relay output contact. Multiple switch contact monitor can be located anywhere on the distributed system.

Combination detector

Combination detectors shall be low voltage, wall-mounted, wide angle microwave or passive infrared detectors with a detection pattern appropriate to cover areas indicated on the plans. Model must be specified on proposed installation layout. The detector shall have an LED indicating light.

Cylindrical Lever Lock

Shall be heavy duty cylindrical lock set, steel, brass alloy construction, lever 4" long; Rose 3" dia.; projection 2 7/16". Store room lock set lock operated by key or inside knob. Outer knob always rigid, inside knob always free.

PART 3. EXECUTION

INSTALLATION

General

The intrusion alarm reporting system shall be installed in accordance with the manufacturer's recommendations and at the locations specified on the floor plans.

The switch section without wires shall be recessed flush into the top edge of the door at the approximate center of the door, and the switch section with wires shall be recessed flush in the top section of the door frame. The two sections of the switch shall be mounted directly opposite each other to provide maximum sensitivity. The wiring from each magnetic switch shall be run to the control panel in the zone dedicated for the intrusion alarm circuit.

Magnetic contact switches for overhead doors shall be mounted as follows. The switch section mounted on the bottom edge of the overhead door shall be without wires. The switch section with wire shall be mounted on the floor directly below the switch part without wires. The wiring from each magnetic switch shall be run to the control panel in the zone dedicated for the intrusion alarm circuit.

The glass break discriminator shall be mounted on the ceiling at locations shown on the plans.

Combination Motion detectors shall be mounted on adjacent walls no more than 60" for the floor at the locations shown on the plans. Wiring is to be concealed in walls, EMT conduit or metal surface mounted wire raceways to protect device wiring from damage or unauthorized tampering. Placement at this height will provide for adequate coverage in the areas to be protected.

Intrusion alarm zoning

Intrusion alarm panel zoning shall be as follows:

Radio Room Office Building (Control Panel item #28)

Zone 1:	Pedestrian Access Door into West Office Area to include: one (1) Digital Keypad (30 Second Delay)(item #2) and one (1) Magnetic Contact Switch-Pedestrian (item #1).
Zone 2:	Glass Break Discriminator in West Office Area (item #3).
Zone 3:	Glass Break Discriminators in the Crew Room (item #4).
Zone 4:	Glass Break Discriminator in Men's Restroom Area (item #5).
Zone 5:	Glass Break Discriminator in Women's Restroom Area (item #6).
Zone 6:	Pedestrian Access Door into South Vestibule Area to include: one (1) Digital Keypad (30 Second Delay)(item #7) and one (1) Magnetic Contact Switch-Pedestrian (item #8).
Zone 7:	Vehicle Access Doors into Equipment Bay Areas to include: four (4) Magnetic Contact Switches-Vehicle (items #9, #10, #11 and #12).
Zone 8:	Vehicle Access Doors into Equipment Bay Area to include: three (3) Magnetic Contact Switches-Vehicle (items #13, #14 and #15).
Zone 9:	Vehicle Access Doors into Truck Bay Area to include: two (2) Magnetic Contact Switches-Vehicle (items #16 and #17)
Zone 10:	Pedestrian Access Door into Repair Bay Area to include: one (1) Digital Keypad (30 Second Delay)(item #18) and two (2) Magnetic Contact Switches-Pedestrian (items #19 and #20).
Zone 11:	Pedestrian Access Door into Mechanic's Room to include: one (1) Digital Keypad (30 Second Delay)(item #22) and one (1) Magnetic Contact /Switch-Pedestrian (item #21).
Zone 12:	Vehicle Access Door into North Repair Bay Area to include: one (1) Magnetic Contact Switch-Vehicle (item #23).
Zone 13:	Pedestrian Access Door into Mechanical Room Area to include: two (2) Magnetic Contact Switches-Pedestrian (items #24 and #25).
Zone 14:	Combination Motion Detector in Equipment Bay Areas (items #26 and #27).

Conduit and conductors

All intrusion alarm system wiring shall be installed in conduit system conforming to the requirements under "Basic Materials and Methods" elsewhere in these special provisions. Conduit size shall be as recommended by the intrusion alarm manufacturer, except that conduits shall be not less than 16 mm diameter. Within the "Office Building Areas" areas, conduits shall be concealed in ceiling or walls. All other conduit shall be exposed.

All conductors and cables for the intrusion alarm system wiring shall be as recommended by the intrusion alarm system manufacturer.

All points of protection must be specifically identified by zone when reporting to the intrusion alarm panel. All points of protection will be transmitted to the U.L. Listed monitoring company.

FIELD QUALITY CONTROL--

Testing

The operational test for the intrusion alarm system shall be performed by the Contractor in the presence of the Engineer. The operational tests shall demonstrate that all functions of the system operate in the manner described in the manufacturer's literature and demonstrate system stability under normal vibration and shocks to components. The Contractor shall notify the Engineer in writing not less than 10 days in advance of performing the operational tests.

Monitoring

The contractor shall provide monitoring services for the facility for one year after the acceptance of the contract. The services shall include a toll-free telephone line connecting to the 24-hour on call monitoring station. Monitoring station shall contact designated site representative in the event of alarm and dispatch an immediate on-site response to the alarm location if the site representative cannot be reached or verification of the cause of the alarm cannot be determined.

Monitoring services after the first year will be handled by the State.

DEMONSTRATION

Training

The Contractor shall provide one hour of on-site training on the use, operation, and maintenance of the system for designated State employees. The Contractor shall notify the Engineer in writing not less than 10 days in advance of proposed training class.

12-16.08 LIFT SEWAGE PUMP CONTROL CABINET

PART 1.- GENERAL

SUMMARY

Scope

This work shall consist of furnishing and installing lift pump control cabinet and control equipment in accordance with the details shown on the plans and these special provisions.

Related work

Thermal and moisture protection for submersible pump motor shall conform to the requirements of Section 12-15, "Mechanical," of these special provisions.

SUBMITTALS

Product data

A list of materials and equipment to be installed, manufacturer's descriptive data, and such other data as may be requested by the Engineer shall be submitted for approval.

Manufacturer's descriptive data shall include complete description, performance data and installation instructions for the materials and equipment specified herein. Control and wiring diagrams, rough-in dimensions, and component layout shall be included where applicable. All control and power conductors on the working drawings shall be identified with wire numbers.

PART 2.- PRODUCTS

Lift pump control cabinet

Lift pump control cabinet shall be single exterior hinged door dust-tight NEMA Type 3R enclosure containing a fixed interior electrical mounting panel and hinged interior deadfront panel. The enclosure shall be made of 1.90 mm (14-gage) steel minimum with all seams continuously welded. A rolled up lip shall be provided around three sides of the hinged door and around all sides of the enclosure opening. The door shall be provided with a neoprene gasket that is attached with an oil-

resistant adhesive. The door shall be maintained closed with door clamps. Security shall be provided by a hasp and staple for padlocking.

The enclosure shall be factory prewired in conformance with NEMA Class IIC wiring. All wires entering or leaving the enclosure shall terminate on terminal blocks. Control wiring shall be 7 strand No. 14 MTW except for hinge wiring, which shall be 19 strand No. 14 MTW. Wires shall be neatly trained and bundled, and wiring troughs shall be provided in the enclosure as necessary. Wiring shall be arranged so that any piece of apparatus may be removed without disconnecting any wiring except the leads to that piece of apparatus.

A wiring diagram encased between two heat-fused laminated plastic sheets shall be provided with brass mounting eyelets and attached to the inside of the enclosure.

Pump main breaker, PMB

Pump main breaker shall be 3-pole, 240-volt, AC, molded case circuit breaker with 100-ampere frame, 50-ampere trip, and interrupting capacity of 10,000 amperes (symmetrical) at 240 volts. Breaker shall be Square D Company, Westinghouse, General Electric, or equal.

Starter, ST1 and ST2

Starters shall be NEMA Size 0, NEMA rated, 3-pole, 240-volt, contactor with 120-volt coil, and non-adjustable overload relay. Overload relay shall be resettable by an externally operable pushbutton on the hinged interior deadfront panel. Overload relay shall have three thermal overload elements and shall trip between 115 and 125 percent of full load motor current, as quoted on the nameplate by the motor manufacturer. Starter shall be NEMA rated.

Pump disconnects, PD1 and PD2

Pump disconnects shall be 3-pole, 240-volt, AC, 100-ampere frame, 20-ampere trip, molded case circuit breaker. The interrupting capacity of the breaker shall be 10,000 amperes (symmetrical) at 240 volts. Disconnects shall be Square D Company, Westinghouse, General Electric; or equal.

Control disconnect, CD

Control disconnect shall be single-pole, 120-volt, AC, 100-ampere frame, 15-ampere trip, molded case circuit breaker. The interrupting capacity of the breaker shall be 10,000 amperes (symmetrical) at 120 volts.

Control relays, CR1, CR2, and CR3

Control relay shall be 120-volt, AC, general purpose relay with 3-pole, double-throw, 10-ampere, 120-volt, AC, contacts. Relay shall be enclosed in clear plastic with 11-pin tube type plug base. Sockets for relay shall be barrier type, 11-contact relay socket with 10-ampere contacts and screw terminals. Relay shall be Square D Company, Potter and Brunfield; Gulf-Western, or equal.

Time meters, TM1 and TM2

Time meters shall be 120-volt, 60 Hz running time meter with 0 to 99,999.9 hours range without a reset.

Seal failure relays, SFR1 and SFR2

Seal failure relays shall be 120-volt, 60 Hz, with transformer, test pushbutton, relay and pilot lights. Relay shall have two single-pole, single-throw (one normally open and one normally closed) contacts having a rating of 10 amperes at 120 volts AC and red and amber pilot lights. The red pilot light shall be for leak indication and the amber indicating pilot light for continuity test. Test pushbutton and pilot lights shall be mounted on the hinged interior panel as shown on the plans. Seal failure relays shall be of the type recommended by the pump manufacturer.

Power distribution block

Power distribution block shall be 50-ampere, 300-volt, molded plastic with two or more mounting holes and two or more branch openings in each pole. The molded plastic shall have a high resistance to heat, moisture, mechanical shock, and electric potential and shall have a smooth even finish. Each block shall have a molded marking strip attached with screws. Terminal blocks shall have tubular, high pressure clamp connectors.

Terminal blocks

Terminal blocks, shall be 20-ampere, 240-volt, molded plastic with two or more mounting holes and two or more terminals in each cast block. The molded plastic shall have a high resistance to heat, moisture, mechanical shock, and

electric potential and shall have a smooth even finish. Each block shall have a molded marking strip attached with screws. Terminal blocks shall have tubular, high pressure clamp connectors.

Neutral bar

Neutral bar shall be 50-ampere copper neutral bar wit h circuit tabs.

Reset pushbutton, RPB

Alarm light reset pushbutton shall be heavy duty oil-tight and momentary pushbutton with one normally closed contacts. The contact shall have an inductive pilot duty rating of 60 amperes (make), 6 amperes (break) and 10 amperes (continuous) at 120 volts and 35 percent power factor.

Selector switches, SS1 and SS2

Selector switches shall be rotary action single-pole, 3- position, 10-ampere, 120 -volt switch. Switch contacts shall have an inductive pilot duty rating of 60 amperes (make), 6 amperes (break), and 10 amperes (continuous) at 120 volts and 35 percent power factor. Selector switch shall have legend plate marked HAND-OFF-AUTO.

Pilot light, PL1, PL2, and PL3

Pilot lights shall be panel mounting light with green lens with screw cap and a direct incandescent replacement LED, 120-volt lamp with candelabra screw base. Light shall be mounted on the interior door.

Alarm light, AL1

Alarm light shall be incandescent, weatherproof light fixture for use with threaded rigid conduit. Light fixture shall have guard and red globe approximately 205 mm in length. Lamp shall be 40-watt, 120-volt standard service incandescent lamp, complete with screw-on type base.

Intrinsically safe relays, ISR1, ISR2, and ISR3

Intrinsically safe relays shall be latching type and completely self-contained solid-state relays approved for use with sensors in Class I, Division 1 locations. Relay shall be suitable for supply voltage of 120-volts AC, with 0.3-ampere, 120-volt rated, single-pole double-throw contact. Relay shall have maximum turn-on time of 5 milliseconds, and maximum output current of 100 microamperes at 28 volts, DC.

Float switches, FS1, FS2, FS3 and FS4

Float switches shall be mercury-activated, 120-volt, 10-ampere, single pole, double-throw (SPDT), float switch in an inert synthetic casing. Switch enclosure shall be leakproof, shockproof, and corrosion resistant. Switch shall be provided with sufficient length of cable to run from the switch position to the explosionproof junction box without splices. Switch shall operate at approximately 90 degrees of tilt. The switches shall come with all the mounting hardware, weights, and assorted equipment necessary to be installed at the elevations as shown on the plans and as recommended by the manufacturer.

Alternator, ALT

Alternator switch shall be 120-volt, 60 Hz, synchronous motor driven, mechanical memory, 60-minute recycling timer with single-pole, double-throw, snap action, 15-ampere, 120-volt contact. Contact positions shall alternate at 30-minute intervals.

FABRICATION

Component mounting

The following electrical components shall be mounted on the fixed interior electrical mounting panel of the Lift Pump Control Cabinet: Panel: Pump main breaker, PMB; Starters, ST1 and ST2; Pump disconnects, PD1 and PD2; Control disconnect, CD, Control relays, CR1, CR2, and CR3; Seal failure relays, SFR1 and SFR2; Power distribution block; Neutral bar; Ground bar, Alternator, ALT; and Terminal blocks, TB. Spacers shall be installed with all breakers (PMB, PD1, PD2,) so that they are externally operable with the hinged door closed. Intrinsically sage relays, ISR1, ISR2, and ISR3, shall be mounted on the fixed interior mounting panel with metal barrier protection and isolated from arcing control components.

The following electrical components shall be mounted on the hinged interior panel of the Lift Pump Control Cabinet: Time meters, TM1 and TM2; Reset pushbutton, RPB; Selector switches, SS1 and SS2; Pilot lights, PL1, PL2 and ;PL3, PL4, PL5, PL6, PL7, PB1, PB2 .

The following equipment shall be mounted on top of the Lift Pump Control Cabinet: Alarm light, AL1.

PART 3.- EXECUTION

INSTALLATION

General

The lift pump control cabinet shall be installed on a concrete pad and oriented as shown on the plans.

All bolts and fasteners shall be galvanized.

All concrete around conduit penetrations shall be finished smooth and sloped in a way to avoid standing water around the conduit.

OPERATION

Automatic operation

Automatic operation of the sewage pumps shall be controlled by relays that are part of Lift Pump Control Cabinet. ISR1 shall energize, ALT shall start timing and the lead pump shall start when the liquid level rises to elevation shown on the plan at which float switch FS1 closes. ALT shall alternate running two pumps with the preset time interval. ISR2 shall pick-up, and both lead and lag pumps shall start when the liquid level rises to elevation as shown on the plan at which float switch FS2 closes. Then, the two pumps shall run simultaneously until the liquid level lowers to lowest elevation as shown on the plan at which float switch FS3 opens and at this elevation both pumps will stop. ISR3 shall pick-up and the alarm light shall be actuated when the liquid level rises to the elevation as shown on the plan at which float switch FS4 closes. Alarm light will remain energized until FS4 opens and alarm reset button has been actuated.